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BRIEFLY TOLD.

A QUEER PROCEEDING IN THE GAS SUPPLY OF TOLEDO, O.—The bustling city of Toledo, O., boasts of a supply of gas from two sources, the first, more reliable and the better being that afforded by the Toledo Gas Light and Coke Company, the management of which concern has been for years, and is now, under the able direction of Mr. Charles R. Faben, Jr. His Company is noted in the history of the artificial gas companies of the State as having been thoroughly mindful of the interests of its consumers, through rendering them service of a high order at the lowest possible rate consistent with fair dealing towards its proprietors. The second source of gas supply in Toledo is on natural gas account, which supply is said to be controlled largely by capitalists resident in Cleveland, O., and whose affiliations are thought to be not altogether independent of what is known as the Standard Oil Company. These latter would like to secure control of the Toledo Gas Light and Coke Company, but who so far have fallen short of their aim in such respect simply for the reason that the present owners of the Company think pretty well of their property. The competition between the two concerns has been pretty sharp, the balance of luck in the trading, however, being largely in favor of Mr. Faben's Company. The natural gas purveyors, in the hope of advancing their cause and swelling their sales, recently took into their confidence, and undoubtedly their pay, a certain G. H. Kirchmaier, Ph.C., who, we understand, is the City Chemist of Toledo, and also Chemist of the Pure Food Commission, whatever that may be, by "asking" him to make an analysis, for publication, of the gas supplied by the Toledo Gas Light and Coke Company and of that supplied by the natural gas concern. The pure food man under the conditions evolved the following:

Artificial Gas.	Per Cent.
Carbon dioxide	5.2
Heavy hydrocarbons	13.1
Oxygen	.4
Carbon monoxide	18.1
Methane	24.5
Hydrogen	18.6
Nitrogen	20.1

He also found that the gas carried 10.57 grains of sulphur per 100 cubic feet and that it had a calorific value of 480 B. T. U. The "Chemist" found this analytical result in his treatment of

Natural Gas.	Per Cent.
Methane	94.1
Nitrogen	5.9

Also, that the sulphur content was 3.4 grains per 100 cubic feet, and that the calorific value was 841 B.T.U. If he were a butcher, one could bestow some charity upon the pure food man's analytical figures, for the above per cents are beyond doubt wonderful in their line. However, his "results" were published broadcast in the Toledo newspapers, possibly and likely at so much per line, and with a view to prejudicing the average gas consumer of Toledo, who is not "greatly up" in chemistry. The Toledo Gas Light and Coke Company naturally did not relish the Kirchmaier story, and in refutation thereof appealed to the editors of the Toledo *Blade*, in which the original trash appeared,

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SMITHSONIAN DEPOSIT

to print the following comment on and refutation thereof, which was done—we submit that the refutation is complete enough to stand without further comment from us:

Editor *Blade*.—The article appearing in your issue of yesterday, purporting to present to your readers a chemical analysis of the gas being furnished the patrons of the Toledo Gas Light and Coke Company, is of such character as to require, as we regard it, absolute denial. The function or purpose of the press, as we comprehend affairs, is to publish the news, and in gathering information for publication, the attempt is always made to gather and present facts.

If we are right in the assumption above expressed, then indeed you have been imposed upon, and very much deceived, by the person, people or concern who inspired the publication of the article now under consideration.

The article, as published, constitutes a very ingeniously conceived "advertisement," and even those who conceived and executed it, we regard as being fully aware of the deception and error concealed therein.

The analysis presented bears the signature of Mr. G. A. Kirchmaier, Ph.C., and chemist to the pure food commission. We are quite prepared to assert that Mr. Kirchmaier does not possess the required apparatus to make a proper and complete gas analysis, and that in this particular case he did not even conduct the analysis presented.

A very important item in gas analysis is the act of securing and storing a true sample of the whole gas. Mr. Kirchmaier may have undertaken the duty of securing such a sample, and the analysis presented by him bears true evidence of the genuine success achieved by him in such undertaking. We frequently make chemical analysis of our product, both of the mixed gases, as well as the straight coal gas, and also the carburetted water gas.

For the information of our patrons we present herewith the true analysis of the various gases distributed by us during the recent past, and we ask that you carefully compare same with the analysis presented by some person, firm or corporation, over the signature of Mr. Kirchmaier, Ph.C.:

	Street Gas. Per Cent.	Coal Gas. Per Cent.	Water Gas. Per Cent.
Light vapors	1.29	.763	4.675
Carbonic acid	1.68	.763	4.025
Heavy hydrocarbons	5.05	1.781	12.467
Oxygen		1.526	.779
Carbon monoxide	10.36	7.124	21.688
Methane	32.25	27.408	24.155
Hydrogen	45.12	58.139	27.623
Nitrogen	4.25	2.496	4.588
	100.00	100.00	100.00

Please carefully note and compare the 2 analyses as presented side by side:

	Street Gas. Per Cent.	Kirchmaier. Per Cent.
Light hydrocarbons	1.29	13.1
Heavy hydrocarbons	5.05	
Carbon dioxide	1.68	5.2
Carbon monoxide	10.36	18.1
Methane	32.25	24.5
Hydrogen	45.12	18.6
Nitrogen	4.25	20.1
*Oxygen		.4
	100.00	100.0

*Oxygen is contained and expressed as contained in heavy hydrocarbons.

The analysis herewith presented was conducted by Mr. H. Hess, of this city, who is regularly in our employ as chemist. Mr. Hess is a graduate of the University of Michigan, and the course of instruction pursued by him while there was, by pre-arrangement, such as to fit him particularly for the work we intended him to undertake for us.

We boldly assert that the analysis presented by Mr. Kirchmaier is not an analysis of our true and regular product, and to the trained mind it exhibits a most ridiculous proposition.

The heat units of illuminating gas are say, 65 to 70 per cent. of that of an average sample of natural gas. The total heating effect of natural gas is greater—no one disputes that; yet, in turn, the flame temperature, or calorific intensity of illuminating gas, is very much higher than that of natural gas; hence the possibility of illuminating gas being used in successful competition as against the natural product.

In further attestation of the position we take, the very large and rapidly increasing use of illuminating gas for cooking purposes by the citizens of this city bears the very highest testimony and evidence.

We are not disposed nor will we continue a controversy the nature and character of which are so clearly outlined by the person, firm or corporation instituting this proceeding; yet in justice to ourselves, as before our patrons, we were compelled to take notice and refute the erroneous analysis they presumed to present.

We thank you for the extreme courtesy of allowing us to set ourselves aright before the consumers of our product in this city.

[Official Report.—Revised by the Secretary.]

PROCEEDINGS, NINTH ANNUAL MEETING OF THE PACIFIC COAST GAS ASSOCIATION.

Held in the Offices of the San Francisco Gas and Electric Company, July 16, 17 and 18, 1901.

First Day, July 16.—Morning Session.

The Association was called to order, at 10:35 of July 16th, by the President, Mr. John A. Britton, of Oakland, Cal. The recording desk was occupied by the Secretary, Mr. J. B. Grimwood, of San Francisco. The following members responded to their names during

ROLL CALL.

Adams, H. E.	Du Val, Wm.	MaHoch, H.
Alstrom, O. F.	Eichbaum, F. H.	Martin, Jno.
Arques, C. L.	Eichbaum, C. W.	McDonald, Wm.
Baker, C. M.	Foveaux, F.	Napthaly, S. L.
Barrett, W. G.	Froelich, C.	Osborn, M. C.
Baurhyte, Wm.	Gillespie, W. W.	Parker, T. R.
Burrows, C. E.	Grant, E. P.	Parker, Wm. M.
Beck, A. C.	Gregory, O. M.	Papst, A. M.
Burrows, C. E., Jr.	Grimwood, J. B.	Pedersen, B. S.
Boardman, M. F.	Guthrie, S.	Petsch, T. D.
Britton, Jno. A.	Gutsch, A.	Powers, R. M.
Brouse, E. H.	Holberton, G. C.	Quilty, C. W.
Carrigan, A.	Hollidge, G. H.	Symmes, F. J.
Casey, W. J.	Hughes, Chas.	Taylor, G. H.
Cheffins, E. F.	Jones, E. C.	Thomas, J. W.
Clements, Jno.	Jones, F. C.	Thompson, Geo.
Cline, W. B.	Joslyn, H. S.	Thompson, J. R.
Colquhoun, G. S.	Kaneen, J. S.	Thompson, T.
Converse, C. M.	Keaton, Geo.	Valentine, R. P.
Crockett, J. B.	Kinney, G. I.	Varney, F.
Cushing, S. B.	Kirk, Geo.	Vanderwhite, A. J.
Decker, D.	Lowe, L. P.	Wiester, W. F.
Druffel, D. O.	Lowe, S. C.	

Report of Treasurer and Secretary.

As Treasurer Mr. Grimwood reported that the cash balance from the previous year was $29.01, and that the collections on various accounts for the current year were $899.50, or a total of $928.51. The expenditures amounted to $859.90, and the balance was $68.61. During the year Volume III. of the Proceedings (containing the transactions of the seventh and eighth annual meetings) was published, at a net cost of $61.65.

As Secretary Mr. Grimwood reported that the membership list, July 31st, 1900, carried 127 names. During the year ended July 1st, 1901, 5 members were suspended, 5 resigned and 3 died. The following

Applications for Membership

for election at this meeting were received:

Baurhyte, Wm., Secy. Pacific Gas Improvement Company, San Francisco; Burrows, C. E., Jr., Walla Walla, Wash.; Decker, D., 627 Ellis street, San Francisco, Cal.; Lowe, Thaddeus, Long Branch, Cal.; Malloch, Secretary Marysville (Cal.) Gas and Electric Co.; McDonald, Wm., Albany, N. Y.; Napthaly, Asst. Engr. San Francisco Gas and Electric Co.; Papst, H. M., Engr. Equitable Gas Light Co., San Francisco; Petley, B. H., Seattle (Wash.) Gas and Electric Co.; Thomas, W., Vancouver (B. C.) Gas Works; Town of Santa Clara, Cal., by D. O. Druffel, President Board of Trustees, Santa Clara; Varney, F., San Francisco Gas and Electric Co.; Wiester, W. H., 22 Second street, San Francisco.

The reports having been received and filed the following

Report from the Board of Directors

was read:

San Francisco, Cal., July 16, 1901.

To the President and Members of the Pacific Coast Gas Association: We, the undersigned, Directors of the Pacific Coast Gas Association for the year 1900–1901, beg leave to report that we have examined the books and vouchers of the Secretary and Treasurer for the above mentioned year and approve the same as correct. Proper vouchers are on hand for all disbursements, and receipts have been properly posted, the balance of cash on hand, as of July 1st, 1901, being $68.61.

The following papers have been submitted, which we approve and hereby authorize for presentation at this our ninth annual meeting.

"Report on International Congress of the Gas Industry, held in Paris, France, Sept., 1900;" by J. B. Grimwood, San Francisco.

"Comparison of Methods of Secondary Distribution of Alternating Currents;" by Geo. C. Holberton, Oakland.

"Promotion of Domestic Fuel Gas Consumption;" by R. P. Valentine, Sacramento.

"Practical Power Transmission;" by John Martin, San Francisco.

"Experience with Carburetted Water Gas Sets;" by A. C. Beck, Oakland.

"Practical Testing of Oils for Gas and Fuel Purposes;" by L. P. Lowe, San Francisco.

"Gas Engines;" by Wm. J. Casey, San Francisco.

We recommend the following for election to membership in the Pacific Coast Gas Association:

W. Thomas, Vancouver, B. C.
B. J. Petley, Seattle, Wash.
W. Baurhyte, San Francisco, Cal.
S. L. Napthaly, San Francisco, Cal.
H. M. Papst, San Francisco, Cal.
W. H. Wiester, San Francisco, Cal.
H. Malloch, Marysville, Cal.
Wm. McDonald, Albany, N. Y.
F. Varney, San Francisco, Cal.
Town of Santa Clara, Santa Clara, Cal.
T. Lowe, Long Branch, Cal.
C. E. Burrows, Jr., Walla Walla, Wash.
D. Decker, San Francisco, Cal.

Also, that the application of the Town of Santa Clara for membership be made in the name of D. O. Druffel personally, with privilege to be transferred to his successors in office as President of Board of Trustees of Town of Santa Clara, personally, as this Association does not recognize companies, corporations or municipalities as members thereof.

Also, that hereafter either the ***banquet*** or the ***outing*** be paid for by subscription of members attending the same. [Signed by the Board.]

The report was received and placed on file. The following

COMMUNICATION FROM MR. L. P. LOWE

was then read by the Secretary:

SAN FRANCISCO, CAL., July 16, 1901.

Mr. J. B. Grimwood, Secretary Pacific Coast Gas Association, San Francisco, Cal.—My dear Mr. Grimwood: In furtherance of the matter of the establishment of a Library in connection with the Pacific Coast Gas Association, and the frequent talks in relation to same which have been held between Mr. E. C. Jones and myself, I beg to say that, owing to the kindness of Mr. Jones in presenting to the Association the very handsome bookcase which he has placed in your care, the situation has been much changed and simplified, and the sum which I had expected to expend for the case namely, $50—I now have pleasure in offering to the Association for the purchase of books, which, with the case presented by Mr. Jones for their preservation, will form a nucleus for what should grow into an extensive collection.

It seems to me the establishment of an Association Library cannot fail to be of very great assistance in many ways, and some method of conducting it can undoubtedly be found which will enable the members to conveniently use same. Yours sincerely, L. P. LOWE.

The President—Gentlemen, what is your pleasure respecting the communication? Perhaps Mr. Lowe had better explain the matter to us more in detail.

Mr. Lowe—There is very little to be said now, and perhaps it would be better to defer it for further consideration. I believe Mr. Grimwood has communicated with a number of members in relation to the matter. It came about in consequence of some discussion a year ago of the advantage to be derived by the members of the Association from a library. At that time I offered to give them a bookcase. Subsequently Mr. Jones presented to the Association the case which you see in the room—a far more elaborate affair than I would have given—and I then stated that the money I would have spent on the case I would now devote to the purchase of books. I presume it is a matter for discussion by the Association.

The President—If there is no objection, the appointment of a committee upon the matter of the library, with power to act, will be conferred upon the President. [So ordered.]

APPOINTMENT OF SPECIAL COMMITTEES.

The President appointed the following special committees:

On Obituaries.—Messrs. E. C. Jones, M. C. Osborn and T. R. Parker.

Committee on Nomination of Officers.—Messrs. L. P. Lowe, O. M. Gregory and J. W. Thomas.

Committee on Library.—Messrs. J. B. Crockett, G. H. Taylor and G. C. Holberton.

Vice-President Burrows assumed the Chair and President Britton read the

INAUGURAL ADDRESS.

[For the text of President Britton's address, see JOURNAL, July 29, p. 162.]

Discussion.

The Chairman—Gentlemen, you have heard this address, which is unusually full of meat. It is my opinion that it should be referred to a committee for thorough consideration.

On motion of Mr. Jones the address was referred to a committee for consideration and report. The committee named by the Chairman comprised Messrs. E. C. Jones, O. M. Gregory and John Clements.

MR. WM. MCDONALD IS CALLED UPON FOR "COUNSEL."

The President—The next on the list is unfinished business or new business. Here I think it would be eminently proper to call upon Mr. William McDonald, Past-President of the Western Gas Association, for a few words of counsel. I want to preface his remarks by stating that I enjoyed very heartily the meeting over which he presided in Chicago last year, and also the solicitous care that he gave to your representative during that time.

Mr. McDonald—Mr. President and Gentlemen: I can only say that it affords me great pleasure to be here. From the address to which I have just listened I have almost concluded that I cannot give you a great deal of advice. Your President, it seems to me, has gone beyond us. One of the great pleasures I had a year ago, at the session of the Western Gas Association in Chicago, was the meeting with your President, and I enjoyed his society very much. Having had to visit the Coast this summer, I took pains to make my stay in San Francisco timely with the meeting of your Association. I anticipate great pleasure in being with you, and in enjoying with you the business and social affairs of the Association. I thank you, gentlemen, all of you, for the kind way in which you have received me.

The President—In addition to the committee on obituaries, I will also appoint a special committee to draft resolutions to convey to Mr. A. C. Humphreys the sympathy of the Association in the great sorrow he sustained in the death of his two sons, whose lives were lost by drowning in the Nile river, Egypt. Mr. Humphreys is an active member of the Association, and has prepared papers which we all have heartily enjoyed. It is no more than fitting that we should take such action. A suggestion has been made that we again take up the proposition of changing our time of meeting. I merely suggest it now, without inviting any action by the convention until a little later in the session.

ELECTION OF NEW MEMBERS.

The President—The next business will be the election of the members proposed. As the Board of Directors recommended the election of all proposed, I think they may be elected by ballot cast by the Secretary.

On motion of Mr. Crockett it was so ordered, and the Secretary cast the ballot of the Association for those named by the Board, who were thereupon declared duly elected members of the Association.

[For the names of the applicants, see report of Board of Directors.]

A TELEGRAM.

The President—I have a telegram from our old war horse, whose voice I am sure will be missed in this session. He was always ready to combat anything not entirely gaseous. The message is:

"Congratulations and hearty wishes for a successful meeting. Cold comfort for me, but the best that I can do this year.—(Signed) W. A. ALDRICH."

I think that in the Association no one man has been with us for so short a time who has gotten his claws so around the heart strings of every fellow in it—and kept them there, too. The Secretary has a letter from Mr. Aldrich which he will later read to you.

On motion of Mr. Clements it was voted that an appropriate response be made by wire to Mr. Aldrich's telegram, the response to be framed by Messrs. Clements and Burrows.

The President then introduced Mr. R. P. Valentine, of Sacramento, Cal., who read his paper entitled

PROMOTION OF DOMESTIC FUEL GAS CONSUMPTION.

[For the text of Mr. Valentine's paper, see JOURNAL, August 12, p. 247.]

Discussion.

The President—Here is an example for you. When I first knew Mr. Valentine he was an electric light man pure and simple; he could see no good in a gas jet. Now he has been converted. He is one of Mr. Aldrich's pupils. You noticed the charming poetry in his paper; also the very close observation of womankind. Whether that belongs particularly to Sacramento I don't know, but it seems to be effective in his case. This is an old subject, of course, but it is always good. One of the things I did not mention in my address was that the answers to questions showed that the increase in sales of fuel gas had been nearly 40 per cent., and returns from a majority of the companies show that the sales of fuel gas are over 40 per cent. of the total. Mr. Jones has had a great deal of experience, and I am sure it will be interesting if he will tell you what has been devised by his Company to reach his consumers.

Mr. Jones—What I may have to say on the gas stove subject is per

haps old to all of you, because I have discussed the matter with the members of our Association before, and I also discussed it before the meeting of the American Gas Light Association at Denver, last October. The method employed in San Francisco has been similar to that of the sewing machine man. Wherever there is a house the sewing machine agent intends to place a machine, and does place one, whether it is wanted or not. There are many women—perhaps 30 per cent.—who do not want a sewing machine, but they are obliged to put one in nevertheless. Now the man who sells these sewing machines is the kind of man we want to sell our gas stoves. His first move is to divide the town into districts carefully mapped out, each district with the houses numbered. In each of these houses someone lives who must cook and eat food. Granted that they must cook food of some kind, they must use a stove, and a gas stove should be just as great a necessity for domestic purposes as water is. The Spring Valley Water Company supplies about 66,000 families with water in San Francisco. These families all cook food. Our Company has about 16,200 stoves in use in San Francisco—I do not know how many the Pacific Gas Improvement Company has placed in the city. Our canvasser goes to the first house on each street and finds out the exact conditions. Whether a gas stove is in use; if so, what kind; whether gas is used in the house for other purposes, and if not used, why it is not used. Perhaps the canvasser may get the reply, "We don't want gas at all;" but the canvasser knows better. He lets that party rest for a little while—perhaps a week or two—and goes to the next house. But that number one on street one must be visited again, and again, and again by the gas stove canvasser, and treated just as a sewing machine agent would treat a lady who wanted a sewing machine—or rather did not want one. In time a hot plate can be placed, or a stove can be loaned, or perhaps the party will come down to one of our cooking lessons. Once a stove has been introduced into a house, for rich or poor, it never comes out. I have made some study during the last year of the cost of cooking on small stoves and lighting small houses for poor people and people of moderate means, and find that lighting by Welsbach burners and the cooking for an ordinary family of three can be accomplished by gas, at our city price of $1.40 per 1,000, for $2 to $3 per month. This, when the convenience and cleanliness are counted, is much cheaper than coal and oil at the price of these in San Francisco. It is much cheaper in dollars and cents. Heads of poor families in this city who told me that they hesitated before putting in gas for all purposes, and taking out the coal stove (that is really the only way to introduce a gas stove, to get them to depend entirely on your gas), said to me later on that the bills at the end of the year were much less; and, of course, they avoided all the ashes, dirt, soot and the time required to build a fire, and the loss of the fire after the cooking is done. I agree with Mr. Valentine that the waterback on the range should be discarded. All the waterbacks that I have seen are crude affairs, coils of thick iron pipe, allowing a great deal of loss by radiation into the kitchen. I think it is better to place the best gas range that can be found, and then to use an independent heater on the boiler. This heater should be close to the boiler, and should have a top connection, so that the water may be heated instantly, if necessary, and also work downwards through the boiler so that the boiler may be heated throughout for water for bathing purposes. I look upon hot plates as valuable auxiliaries; especially in large houses where ranges are placed they are useful for heating irons and other minor purposes. You will remember some years ago I reported that our Company put in some 300 or 400 supplementary meters for measuring cooking gas. The grand average of these meters was 1,666 cubic feet per month. This, at our rates, would amount to $2.33 per stove per month. You would not sell this gas in any other way, excepting through these gas stoves; you must always consider that in selling gas for fuel. Suppose your gas cost you 50 cents per 1,000 in the holder, the amount of gas used in each of these gas stoves would cost the company 83 cents per month, giving a profit (we will call it profit) of $1.50 per month. This would be $18 per year revenue, which would not be received if the gas stove had not been placed. That is 100 per cent. on an $18 stove. We could almost afford to give the stoves away. I will put it in this way—no gas company can afford not to have a gas stove in the hands of every one of its consumers.

The President—That, to my mind, is the proper kind of talk. We want somebody to stiffen our backbones a little. The trouble with most managers is they are afraid to go ahead with anything. Results as those Mr. Jones has reported to you should help you more than anything else. Mr. Quilty, I am glad to see you here. We have missed you in past years. You have had some little doings with gas stoves in San Jose. Suppose you give us some of your experience in that line.

Mr. Quilty—While I have had to be absent a couple of years, I have not lost my love or appreciation for the Association, or my respect for its work; nor have I felt satisfied with myself for having lost these two years. I am getting rusty, and while the time of the meeting has been very inopportune for me, on account of other business interests which kept me away, I have made up my mind that in the future I shall be here and let other things rest. In regard to gas stoves, I do not know that I can add anything to what Mr. Jones has said. At San Jose we now have about 1,500 gas stoves in operation in a town of 25,000 inhabitants. We have put in about 500 or 600 in the last 10 months. We pursue the policy which Mr. Valentine has outlined. We tried loaning stoves and selling them on installments, but these methods are unsatisfactory. We at last adopted the policy of furnishing stoves at actual cost, plus the freight (a mere bagatelle) and a charge for pipe and labor sufficient to cover the expense. To large consumers we sometimes remit the charge for fittings. Our business in that line has increased so—there is such a demand for stoves—that it worries the Company to pay for street mains to reach the consumers. Our gas stove consumption has increased from 10 or 15 per cent. of the total 3 or 4 years ago, until now I believe that 45 per cent. of our consumption is represented by gas used in gas stoves. In 1 year our consumption increased 35 to 40 per cent. Our output of gas for June, 1900, was 1,500,000 feet; for June, 1901, it was over 2,000,000 feet; and that in the face of competition. We ascribe that great increase simply to the use of gas stoves. I can say nothing further because I think that Mr. Valentine and Mr. Jones have covered the field. I think our President could give us a few points if he would condescend to entertain us.

The President—It is the special prerogative of the presiding officer to maintain silence; but I cannot keep quiet on this subject, for it is one of my hobbies, so I am going to say something if it is out of order. We, perhaps, in Oakland have better means of determining the value of the gas stove than almost any other Company on the Coast. I think we are the only Company that makes a distinctive rate for fuel, and separates the consumption of the gas stoves by separate meters, so that for every gas stove out we have a known consumption. I want to substantiate Mr. Jones in regard to the average consumption he mentioned (1,666 feet). Our consumption for years has varied but a trifle from 1,800 feet per stove per month. Where companies do not make a special rate they do not realize how much money a stove is earning. If they would take that to heart, and figure it out in dollars and cents, they could go to any banker and borrow all the money they needed—if they had not the money themselves. The question of what can be done with the sales of stoves is purely a local matter. Every manager has to take that up in accordance with the temper of the people. He knows the conditions better than you or I do. I cannot presume to tell you how the people in Chico, or in Sacramento, or in Red Bluff would act under certain conditions. The man who is in touch with them for 24 hours a day knows. Mr. Lowe is a man who had had a great deal to do in the matter of forwarding this gas fuel business. I think he has given this subject a great deal of attention. Get to your feet Mr. Lowe, and tell us about it.

Mr. Lowe—It strikes me that this matter is working itself out very rapidly, and we are becoming a unit, so far as the gas stove is concerned. I think that possibly my father was one of the original gas stove cranks of the country. I remember that many years ago we had to build our own stoves to supply our gas works. We built a great many water gas works, and at that time there were only one or two gas stove manufacturers. Their stoves were not as good as they might have been, and were rather too high priced; so we took up the question of manufacturing stoves. One of the propositions that struck us with particular force at that time was the question of giving away gas stoves. It is a thing that figures out most magnificently on paper. You can expend $20,000 and find that you pay for your stoves within a short time. But experience in that line taught us (and it did not take very long) that it was one of the worst methods. We found that stoves given to consumers did not last long. They had no financial interest in it, and in that case they don't think very much of it anyway. Stoves were continually coming back filled up with grease, with the burners clogged, and the cocks stopped up. We were convinced in two or three years that it was the very worst thing we could possibly do, notwithstanding that it figured out so magnificently. The only way you can really bring the subject right down to the attention of the consumers is by seeing that they have a financial interest in the stove. When they have they study the question. The woman who pays for her stove keeps it clean; the woman to whom a stove is presented or loaned leaves it dirty. Years of experience in that line have convinced me that the best thing to do is to sell the gas stove to the consumer, if necessary, at cost. But I do not believe that it is necessary to

sell at cost, any more than it is necessary for a hardware man to sell a coal stove at cost. However, that is a matter of opinion. I think if you can make a dollar or two of profit you are better off, and under the circumstances the consumer does not feel any particular burden. However, my practice has been as a rule to sell stoves at cost, and to make a slight profit on the connection. On the other hand, I have frequently pursued the policy of earning a little money in the gas stove account. I have found it a good practice to let a person take the stove exactly as he pleased. We talk a great deal of the convenience and comfort of a gas stove, but economy is the main question with the ordinary consumer. My practice has been to place a stove on trial for anyone who wanted it. If the consumer was a precarious one, I put in a prepayment meter. If they can purchase a stove in easy stages, they are more apt to take it; and my practice has been to say: "How do you want to pay"? Some pay cash; others a portion in 30 days; others in 60 days, or longer, as it may be. My instructions to our collectors have invariably been to take any system of payment that the consumer offers, and simply to call at the time that they say to come and get the money. If they are not quite ready, politely ask when to call again. Go at that particular time. If they are not ready then, ask just as politely when to call again. After three or four calls they get a little tired of the collector's visits and pay. After a number of years' experience, I do not think I have lost altogether $100; and for the few people who put in gas stoves on trial and took them out and refused to pay for gas because it was in the agreement I have not lost $10. I am satisfied that every location is a law unto itself. Every gas man knows best how to deal with his people. I believe in selling a gas stove as any other concern would sell its wares. I believe in making a slight profit on the stove, and a slight profit on connecting, and then taking your pay as your consumer wishes to give it to you.

Mr. Valentine—Regarding the amount of gas used for different purposes, we found in Sacramento a short time ago, as nearly as we could calculate it, that we were supplying about 80 per cent. of our gas for fuel purposes. We found it a good custom to instruct our consumers how to use the water heaters. For example, in case they want to take a bath, we have them light the fire, keep it going for a few minutes, then go into the bath room, turn on the water heater, and by the time they are ready to take the bath they can shut off the heat with the water at the right temperature. Two days after we place a stove we have a man call at the house to give any information that is necessary. Ten days afterwards the man visits the house, reads the meter, notes what has been used, instructs the people how to read the meter, tells them how much gas they have used and shows them how to economize. We find that to be a good custom because the consumer is satisfied. Speaking of profit on stoves, we found, on making up our trial balance, that we had made a profit of $48 on all the stoves sold in one year.

Mr. Lowe—There has been a disposition to decry that good old hot plate, and I cannot understand it. I remember last year our friend Osborn had something to say in that respect. Now if there is one disadvantage that a gas stove presents over a coal stove, it is that we have a limited amount of heated top surface. A coal stove is hot all over, while with a gas stove it is necessary to keep nearly immediately over the burners. Consequently our space is limited, and in practice a hot plate is a good thing to have. When I kept house I used gas exclusively for cooking purposes, and found that a hot plate with a portable oven was an excellent thing. I believe that a hot plate can be gotten into a place when you cannot introduce a gas stove. It is inexpensive. I think the hot plate is really a great assistance in the sale of gas appliances. I believe, as Mr. Valentine does, that a water back attachment should not be placed by anyone.

The President—Mr. Osborn, you have to answer that proposition about hot plates. You have moved, and perhaps you have changed your opinion.

Mr. Osborn—I have been very much interested in the paper and the discussion, and in the statement in our President's address that the consumption of gas on the Pacific Coast had increased in the last 10 years 100 per cent. That is the reason we have reduced the price of gas on an average 33 per cent. That is the only way to reduce the price of gas. It is simply a question of consumption. The gas stove has turned the trick. It proves that the man who now goes to the gas works to figure out how much he can reduce the cost of gas in the holder is not the man who will succeed. It is the solicitor who does the work. The solicitor is becoming more important than the gas engineer. The man who gets the business is the man for the company. Regarding hot plates, I must say that I have modified my opinion somewhat. If you can get in a gas range, get it in; if not, get in a hot plate, if it is only a nursery burner. Get them started. Competition is useful in the introduction of gas stoves. In Marysville, where three years ago not a dozen ranges were in the town, 1,000 gas ranges and appliances are now in use. In Chico, since the 1st of April, we have placed 65 ranges—three of them being hot plates. A point in regard to reducing the cost of gas, which I think is a good one, and which I have adopted at Chico, is that I add 50 cents to the price of the gas if the bills are not paid before the 10th of the month. Some of the people say to me: "Now, Osborn, you are really selling gas at $2. You are adding 50 cents simply to make us walk down town." I say: "Yes. It is enabling me to save $75 per month, I am able to sell you $2 gas in Chico, whereas if I increased my expense by the salary of a collector, you would have to pay for it. You get $2 gas because you assist me." I collect 100 per cent. in the office, both in my gas and electric light business. There will be in the Company in which I am employed within the next year a revolution in the gas industry. There cannot but be by the methods employed.

The President—That is a man whom the Association has made. I remember him when he came from Virginia City. He has grown up with the business and is one of the men who has benefited as much as anyone from his attendance at the Association meetings. He has never missed a single session. You notice, Mr. Lowe, the remark that three of those 65 ranges were hot plates. (Laughter.)

Mr. Osborn—It does not make any difference how "low" your price is. If the gas stays in the holder, it does you no good.

Mr. Lowe—The idea of a gross price and a discount is very good, if it is insisted upon. A discount system, lived up to, will get your money in.

The President—You have listened carefully to this discussion, and I suppose you still retain a little remembrance of the sandwiches that Mr. Valentine spoke about; so we will declare this convention adjourned until 2 o'clock, for luncheon.

First Day, Afternoon Session.

The Association reconvened at 2:25 P.M., and the discussion on Mr. Valentine's paper was resumed.

The President—Having thoroughly satisfied the physical man, as I presume all of you have, the mental man will again take sway. I trust everyone of you can say his meal was cooked on a gas stove. As the matter of gas stoves was so ably discussed this morning, and was not concluded, I feel it advisable to continue the discussion for a little period this afternoon, more especially with respect to the use of prepayment meters in connection with gas stove installations. Mr. Parker, I was suggesting that perhaps some member could give his experience respecting the use of prepayment meters for gas stoves.

Mr. T. R. Parker—When we were trying to introduce gas stoves at Napa, the remark was made by one of our consumers: "If I could pay for my gas before I used it in the gas stove, I possibly would not be affected with dyspepsia when you presented the bill." That was his excuse for not using gas for cooking. I had heard of the prepayment meters, which were then in use in England, and sent for some. I put one in for this man, and he became a consumer immediately. They have been a considerable success, because people who growled about the size of a $2 bill would put $8 or $10 in the prepayment meter and not say a word. At present we have over 200 in use, and the consumers ask for them continually. Under the new administration at Napa the reduction in the price of gas, with a rebate if bills are paid before the 10th of the month, is working its way, inducing a great many to take gas and receive the benefit of the rebate, leaving no outstanding bills, and saving the time of a collector.

The President—Have you found the meters as trustworthy as ordinary meters?

Mr. Parker—We have made a comparison after 6 months' use, and have found them within 5 per cent. of being accurate.

Mr. Valentine—Do you have any trouble with bogus coins?

Mr. Parker—Yes, we had; and on taking them out all we could do was to hand them to the consumer and say, "I presume you used this by mistake."

Mr. Valentine—Have you had any difficulty with thieves?

Mr. Parker—Only twice; nothing to speak of.

Mr. Osborn—I wish to add that one of the great difficulties in the interior towns in the way of the distribution of gas for fuel is that the towns are not piped. The residence districts generally do not use gas for illumination, so that it calls for quite an expenditure of money for piping. The first matter that we have to take up is proper distribution. The principle that we have been following out in piping the residence portions of our towns for illumination is a wrong one when it comes to supplying gas for fuel purposes. The mansion is not the place for the gas stove. You must reach the poorer classes in order to sell gas for fuel.

Mr. Burrows—Perhaps it would be interesting to have some statement as to the price at which gas is sold in the other towns. In Sacramento, I believe, part of the gas is natural gas, and may be in other places too. It would be interesting to the coal gas man to know at what price they can afford to sell gas.

Mr. Valentine—We are using a mixed gas, natural and manufactured, selling it at $1.65, and competing with natural gas opponents who sell gas for $1. In some cases we find we can give better results with our mixed gas than with natural gas.

The President—I hoped that Mr. Adams of Stockton would be here. He is mixing natural and artificial gas.

Mr. Burrows—Coal or water gas?

The President—Coal gas entirely.

Mr. Valentine—Ours is water gas, and we mix it in the receiving holder. In mixing it in the distributing holders it did not mix thoroughly; but when we put it in the receiving holder it mixed freely, and as long as we do not undertake to handle over 40 per cent. of the natural gas, we have no difficulty whatever.

The President—No stratification whatever?

Mr. Valentine—None whatever. We cannot go beyond that per cent. and use it in the open jet without using aluminum tips and packing the pillars.

Mr. Burrows—What candle power do you get with the 40 per cent. mixture?

Mr. Valentine—With a Jones photometer we get 22, but that does not represent the actual illumination by any means.

Mr. Burrows—Is the 22-candle power based upon a water gas photometer?

Mr. Valentine—Yes.

Mr. Lowe—It seems to me that it should be explained there is a good reason for such a reading. If I remember rightly, the Sacramento natural gas contains a large percentage of hydrogen, and is a light gas. Under those circumstances, a Jones photometer for water gas would not be a correct instrument.

Mr. Valentine—We do not pretend to distribute an illuminating gas.

Mr. Lowe—What do you think the candle power really is?

Mr. Valentine—I should judge, about 16.

Mr. Lowe—I asked Mr. Valentine because the mixed gas struck me as being a gas of about 16-candle power.

The President—It is satisfactory as a fuel gas to your consumers, however?

Mr. Valentine—Yes.

The President—Mr. McDonald perhaps knows more about prepayment meters than any other man here. We should be glad to have him give us some information.

Mr. McDonald—Of course that is a subject which hits me where I live; therefore, I hesitate to talk about it. With your permission I am going back to say a word on the discussion this morning. I pretty thoroughly agree with Mr. Lowe in his manner of getting out gas stoves. I, of course, have no personal experience, but hearing a great deal of what is being done by the gas men I find that in the East they are drifting to a place where they sell stoves at some price. They do not believe it is good policy to give them away. Of course, they adjust themselves to the ideas of the consumer. They accommodate the consumers in the way of payment all they can, but still they make the consumers pay for the stoves, because they see that the consumers will value the stoves more highly, and take better care of them when they have to pay for the stoves. Now, as to prepayment meters. Of course, it is not possible in most of the gas companies in California to pursue the policy that has been pursued where most of the prepayment meters have been placed in the East. New York city has probably somewhere in the neighborhood of 60,000 to 70,000 prepayment meters in use. In New York they have educated the people up to the place where neither the gas company nor the consumer has to put in the gas stove. That is to say, in building flats and houses for rent the owner must put a gas stove in the house or he cannot rent it. I think this is worth while thinking about, especially in the larger cities, so we might get that idea into the minds of the people who are building dwellings or flats. A landlord can rent his flat much more advantageously if he has prepared it for the use of gas and has a gas range in it. The prepayment meters encourage the use of gas for illuminating as well as for gas stoves. I was told within three months that the Consolidated Gas Company, of New York, was selling 500,000,000 feet of gas per year through prepayment meters that it had no idea it would have been able to sell if it had not been for the prepayment meter. They reach the poorer people who are not accustomed to burn gas. Of course, I realize how much better you are fixed here for the use of gas than we are in the East, on account of climatic changes. We have winter and summer; here you have nearly the same kind of weather all the year around. Here a gas stove would be used continuously. There it might be used only during the summer. But they have tried to fix the thing in such shape that the consumer does not have any means of cooking except on his gas stove; and that has been accomplished to a very great extent in the city of New York, and of course to a greater or less extent in the other large cities.

Mr. Osborn—Are these flats steam heated?

Mr. McDonald—Yes; they are all steam heated. The gas stoves are put in by the landlord, just as the fixtures are, and he finds that he can rent his flat for from $1 to $3 more per month with these facilities than without them. I understand that this is not easy to accomplish in California, but it is an idea worth pursuing, so that the gas stove may become not a luxury but a necessity. In regard to prepayment meters in particular, I can frankly say that no company has ever started to use the prepayment meter without being pleased with it. While I make and sell prepayment meters, I do not advocate placing them for the majority of consumers, but simply for the consumer who cannot be obtained in any other way. I have known instances where many consumers—and good consumers, too—have been obtained by the use of prepayment meters, when they could not otherwise have been secured. The mechanic, the man who is earning from $15 to $20 per week, finds that he can burn gas with a prepayment meter and not feel the burden. Regarding the amount of gas used in prepayment meters I have some figures. The average in New York city is about 14,000 feet per year, with the ordinary prepayment meter in the small flat. While it is a small amount, yet in the aggregate it counts up in the course of the year. I do not know, Mr. President, that I can say anything more, unless some of the members have questions to ask.

Mr. Lowe—What has been the growth of the prepayment meter business? What percentage of prepayment meters is being made?

Mr. McDonald—It has increased very largely. Of course, I speak more from the knowledge of my own business and factory. We are selling about the same number of meters that we were selling 2 years ago, but we have supplied the Consolidated Gas Company of New York almost entirely with prepayment meters, and they have their field filled to a great extent. Our sales to them have, therefore, fallen off, probably 30 per cent. or 40 per cent.; but we have more than made it up by the increase of our business with other companies. The prepayment meter is increasing in favor with those who use it, but there are yet many people who have never used it, and do not know of its advantages. I should say that about 25 per cent. of the meters sold in the East are prepayment meters.

Mr. Lowe—And that trade has been developed within a few years.

Mr. McDonald—Yes. It is 5 years ago this fall that I went to England to secure the rights for prepayment meters, and about 5 years since I began to put them on the market. In that time I have sold about 80,000 prepayment meters.

Mr. Lowe—That is an excellent showing.

Mr. McDonald—Yes. And other concerns are selling prepayment meters largely, too. The prepayment meters that are now being put upon the market are almost perfect in their action. I think there are 3 or 4 concerns putting meters on the market that would not be afraid to guarantee that the coin would agree with the registration within 1 per cent.

Mr. Osborn—What is the nature of the complaints about the meters?

Mr. McDonald—The worst complaint is the possible working of the meter in some way without leaving the marks. Of course they leave discrepancies between the coin and the registration. Sometimes the locks are picked. Sometimes they succeed in working the meter by means we can hardly discover. It is impossible to provide against an expert working the meter in some way. Of course, the question of lead coins and brass pieces does not amount to anything. The gas companies who use prepayment meters have gotten beyond that. They do not care, as long as the evidence is in the box. They present the coins to the consumer and say: "You must have made a mistake." The only difficulty that has been encountered is where someone gets a key, goes around, opens the boxes and locks them, and leaves no record behind. It is very hard to tell what has happened. Of course they have arrested people now and then. But the percentage of that sort of thing is very small.

Mr. Lowe—Suppose the meter taker in going his rounds finds a greater amount of money in the box than the amount of gas already burned calls for. What is the practice of the collector?

Mr. McDonald—I could not answer that question, Mr. Lowe, because I do not come into contact with that end of it. I presume he takes the

money and adjusts it with the consumer afterwards. We assume that the gas company is honest and does not take pay for gas not furnished.

Mr. Lowe—Of course the meter would give the consumer credit anyway.

Mr. McDonald—Of course. And only a certain number of quarters can be put in. You can pay for 2,000 feet in advance, if you want to. The consumer might come along with six or eight quarters and put them in, but he is not apt to do it.

Mr. Lowe—My instructions to collectors have been to take only the amount of money representing the gas consumed, leaving the rest of it in the box.

Mr. McDonald—That may be the custom of the companies in the East, but it is one of the things I am not familiar with. The manufacturer hears only of those things which are troublesome to the gas company. When it gets too much money, it does not complain to him.

Mr. Crockett—It seems to me that after the money once gets into the box it does not affect the registration any further.

Mr. McDonald—No; not at all. After the money is in the box the meter will run until the gas is consumed.

Mr. Lowe—The small hand that moves ahead shows how much gas is coming, but there is no actual registration on the dial until the gas has gone through. I should think the simplest way would be to allow the surplus to remain in the box.

Mr. McDonald—Some difficulty has been experienced through people who put money into the box and moved before the gas paid for was used. The money would remain in the box, but the consumer could not be found. I presume the companies put that into a fund for the benefit of the sick.

Mr. Valentine—Would Mr. McDonald say something regarding the cost of repairs to prepayment meters?

Mr. McDonald—The cost of repairs for prepayment meters is relatively no greater than for ordinary ones. It has been our practice to repair the meter for the same money. When anything is wrong with the prepayment device we repair it and charge actual cost with a moderate profit. I do not suppose that the repairs on prepayment meters, outside of the meter itself, have amounted to 1 per cent. of the cost. The prepayment devices now being made and sold in the East will in almost every case outlast the meter itself; so that the repairs to the prepayment device amount to nothing.

Mr. Valentine—If anything happens to the prepayment part, you can repair that separately?

Mr. McDonald—Yes; and I do not think we have ever charged over 50 cents for repairs.

Mr. Crockett—The prepayment meter in which you have deposited your money is supposed to run just long enough to supply you with the gas paid for. Suppose that were to occur about 8 o'clock in the evening, when there were several jets lighted through the house. The consumer, finding that his gas has been exhausted, goes to the meter and drops in a few more quarters, without shutting off the jets, but neglects to light them again or to shut them off. Might not cases of asphyxiation be liable to occur?

Mr. McDonald—That has interested me greatly. It has been talked of considerably, and possibly, when prepayment meters were first made, it seemed to be the aim of the manufacturer to have the meter cut off sharply and quickly when the coin was exhausted. But he has gotten over that; he knows better now. I speak more particularly of the meters which I manufacture—but I think it is true of the others—when I say there is no danger at all of that happening now, because the meter will be hours in putting the light out. It will cut the light down gradually, or until it is down so far that it is of no service to anyone, and then it will continue, I think for 10 or 12 hours, before it actually turns the gas off, so that there never has been a case with the better class of meters when asphyxiation was possible. It happened once or twice, and I have known of meters made by firms who thought that the only aim was to cut the gas off at once. The meter should not cut off sharply, but very slowly. If it happens to take 25 feet of gas more to shut it off, there is no loss for it counts on the next quarter. It is a continuous device, and will necessarily take it up on the next quarter. Whatever loss there is occurs only in one quarter. I think, if you will look into the matter, you will find that there is very little danger in the instance inquired about.

Mr. Lowe - I have never seen any meters that did not close gradually.

Mr. McDonald—At first they tried to make them shut off sharply.

Mr. Crockett—I have seen reports of a number of cases of asphyxiation.

Mr. McDonald—There have been a few cases, but I think not over 5.

Mr. W. M. Parker—We have had about 300 prepayment meters of different kinds, and with some of them experienced the difficulty mentioned by Mr. McDonald—the shutting off too quickly. I personally adjusted them so as to make the meters shut down gradually, and our consumers were instructed that when they saw the light grow dim and come up again, it was time to put in a quarter.

Mr. Lowe—It would ultimately close, though?

Mr. Parker—The last time it closed off entirely, but not the first time. Almost any meter can be fixed in that way, and it can be done in your own shop.

Mr. Grimwood—I would like to corroborate Mr. McDonald's remarks in that respect, although my experience has been only gained in the laboratory. I found that the meter began to shut off very rapidly until the flame was very small, not giving enough light to see across the room, but yet being perfectly safe. From that time on it took 10 or 12 hours to shut off, consuming not more than a foot of gas. Apparently it was perfectly safe. There was no danger of its being shut off until the people had had ample warning. The question came up regarding the specific gravity of natural gas. I analyzed a number of samples and have one here at my disposal. It was taken from the vicinity of Stockton. The specific gravity is 0.5638, or say .560 compared with the average specific gravity of coal gas of about .540 and carburetted water gas of about .615. Most natural gas is almost pure marsh gas; or, I should say, a great deal of it is. Marsh gas has a specific gravity of .556, so that you see this particular sample is only a trifle greater, probably due to a small percentage of carbonic acid gas. The natural gas of the Pennsylvania and Ohio fields is usually figured at about 1,000 heat units; the gross British thermal units of this particular sample, calculated from analysis, were 890. I was told the gas came from the vicinity of Stockton.

Mr. Lowe—California natural gases are more nearly like those found in Pennsylvania, and vary considerably from the Indiana types.

Mr. Grimwood—I think the California gases vary considerably. I have had samples which showed a very considerable variation in composition, but I did not gather them myself, and cannot tell what care was exercised in taking them. That often influences the analysis very decidedly.

Mr. Jones—I have in mind a sample of gas taken from well No. 2 at Stockton. I think the impression might prevail that the natural gas of California was very similar to the natural gas of Pennsylvania, where the gas is made up mostly of marsh gas, and it has become a popular thing to quote natural gas as a unit—that is, 1,000 heat units to the cubic foot. That would be an error in California, because most of our natural gases are poorer than those found in the East. I have calculated the British thermal units of this sample and found them to be 689.6 per cubic foot, very much poorer than most of the Pennsylvania natural gas.

Mr. McDonald—Do the California gases not carry sulphur?

Mr. Grimwood—No sulphuretted hydrogen, so far as my experience goes.

Mr. McDonald—The Indiana gases all carry sulphur.

Mr. Grimwood—In answer to Mr. Jones I would like to quote the analysis of the gas, the specific gravity of which I gave you—the figures given show the average of 3 analyses:

Carbonic acid	.37
CH_4	.15
Oxygen	.50
Marsh gas	92.38
Nitrogen	6.60
	100.00

Mr. Lowe—I could imagine a sample of gas of that description coming from an oil well; but I do not think it is a fair sample of the gases of California as they are used in practice.

Mr. Grimwood—I only said that there was a considerable variation in the natural gases from different parts of the State. The three analyses of this particular sample compared within .4 of 1 per cent.

The President—I think Mr. Grimwood has some interesting facts connected with the discussion of prepayment meters as brought out at the Paris Congress.

Mr. Grimwood—At the Congress of September last a paper was read entitled, "Results Obtained in Holland from Prepayment Meters." The paper contains a vast amount of information on the subject. It is impossible to go through all of it, but some of the statistics may be of interest to you. One table gives the years in which prepayment meters were first introduced into the different towns of Holland. According to this table, which extends to 1899, they were first used in 1895. In

Utrecht, for instance, there were 231 in use December 31, 1895, with a steady increase, to December 31, 1899, at which time 5,771 were in use. There are a great many other figures, all of which show that there has been no decrease, and in many instances a phenomenal increase. Wherever they are installed they are thoroughly satisfactory. The author gave other tables showing the number of inhabitants, the gas purchased, the size of the prepayment meters, and the number of ordinary meters as compared with prepayment meters. I think it would be worth the while of anyone to look the tables over. I have picked out the few following figures and facts from the paper:

"Holland, where the system in question (prepayment meters) was introduced five years ago, has about 100 gas works, large and small, 43 of which have placed prepayment meters at the disposal of their patrons. The population of the 43 cities using prepayment meters is 1,950,829. Those in which gas is sold, but without prepayment meters, have a population of only 386,320. Utrecht, the first city in Holland using prepayment meters (1895) had, December 31, 1899, 5,773 out of a total of 7,746 meters. It would be unfair not to give prominence to the fact that prepayment meters have a powerful influence towards increasing the consumption of gas in general. All my colleagues are of one accord in that they agree that prepayment meters are the best means to popularize, in every sense of the word, the use of gas, particularly for cooking; and that the prepayment meter, wherever it is adopted, is the best advertisement for the gas works."

Mr. Lowe—I do not understand why the prepayment meter should not become as popular as the nickel-in-the-slot telephones, which far outnumber the other styles.

Mr. Osborn—I understand they bring in more money to the telephone company, too. Is that the case with the prepayment meter?

Mr. McDonald—Yes; but with some consumers not so much as we might expect. Not wanting to present anything that is not absolutely fact, I may say that in some cases there has been dispute regarding the increase. In other instances the consumption has undoubtedly increased largely.

Mr. Lowe—In any case, the prepayment meter has not lessened the consumption any?

Mr. McDonald—No; the consumption is greater. The people using the meters are mostly poor people, who are careful. In New York city, where gas sells for $1 per 1,000, 25 cents a week runs a family for both fuel and light.

Mr. Foveaux—Has it ever occurred that the meter would stop registering when the people were out of a quarter. Suppose it is towards midnight, and the person using the meter has not a quarter.

Mr. Lowe—If it is midnight you don't want gas.

The President—There is no meter that would not do the work on a nickel. They work on a nickel as well as on a quarter.

Mr. McDonald—It is very uncertain. You might try 5 nickels before you got one to work.

Mr. H. M. Parker—When we set a prepayment meter we make a practice of asking the consumer to get 4 quarters so that we can show him how to operate it. We tell him that if he keeps that practice up he will never be without gas. In that way we have very little difficulty in keeping the consumers continually ahead. Some of them undertake to tell us that when they put in $2 worth they get more gas for the money.

Mr. McDonald—I suppose all managers of gas works have discovered that the public are very knowing on the things they want to know; but that it is very hard to teach them the things they don't want to know.

The President—If there is no further discussion, we will pass the subject and take up Mr. Grimwood's paper.

Mr. Grimwood—I would like to call your attention to a table in which the amount of gas consumed through prepayment meters is compared with the amount of gas consumed through the ordinary meter. I think you will find it of interest afterwards. In some instances the amount of gas consumed by the prepayment meter is considerably more than that consumed by the ordinary meter, exactly how much I have not figured out.

Mr. J. B. Grimwood, of San Francisco, read his paper entitled

REPORT ON THE INTERNATIONAL CONGRESS OF THE GAS INDUSTRY, HELD IN PARIS, FRANCE, SEPTEMBER, 1900.

[For the text of Mr. Grimwood's paper, see JOURNAL, August 12, p. 242.]

Discussion.

The President—Gentlemen, you have listened to a very able and interesting exposition of the Exposition. Mr. Grimwood has absolutely observed all there was to observe on that trip. I have no doubt he has a fund of information other than that in his paper which he will gladly give to any of you who may want it. One thing I want to ask is whether or not high pressure distribution has been tried on the Continent?

Mr. Grimwood—The only places I heard of were at the Exposition grounds and at Greenwich, England, where they have done a great deal in that line. The engineer there I think has written something about it in the English technical press, and is a strong advocate of high pressure distribution. I presume you refer to high pressure illumination service, 7 or 8 to 15 or 20 inches supply at the burner. If you mean high pressure distribution, amounting to from 5 to 25 pounds, I do not think that has been tried anywhere in Europe; at least not to my knowledge. Perhaps Mr. McDonald could inform us.

Mr. McDonald—I do not think they have tried it in Europe at all. When Mr. Shelton wrote his paper it excited very great interest on the part of engineers there.

Mr. Grimwood—I think the paper was favorably received. Of course, there was the difficulty of language. In my own case I am still reaping great benefit from the Convention, and I think it will continue for a long time to come. It is impossible to absorb the information contained in a volume of this sort in a few months. I think the other members in attendance very likely had the same experience. I did not realize at the time anything like the importance of that convention. Now that it is over, and I have had an opportunity of digesting what took place there, I find that I had no conception of its importance.

Mr. Lowe—You spoke of the price of gas in Glasgow in 1899. Did you get the price in 1900?

Mr. Grimwood—When I was there in 1900 I could not get the official statement for that year. I made a note of the price, but have been unable to lay my hands on it. I think it was 2s. 2d. At that time there was a great deal of public comment because it was thought the price of gas was to be raised on account of the enormous increase in the price of coal.

Mr. Lowe—A rise of a cent or two a thousand?

Mr. Grimwood—Yes. The selling price of gas in London is different in the various companies: 2s. 6d. on one side of the Thames and 3s. 6d. on the other side. In London they have a sliding scale. Parliament fixes the price to be charged by certain of the London Companies. When the price of the gas had been fixed the Companies were allowed to raise or to lower it, subject to these conditions: They were allowed to pay a certain rate of interest on their investment. If they saw fit to increase the price of gas, they were compelled to make a corresponding reduction in the dividends paid to stockholders. The lower the price at which they could sell gas, the greater dividends they were allowed to pay. They have also, not exactly a system of merits, but a system by which the employees profit to a small extent in the results of the year's work. If they are able to pay a certain dividend. a small per cent. goes to the employees. In one company they have in the directorate an employee, a man who represents the laboring class.

Mr. Lowe—Does he represent any financial interest?

Mr. Grimwood—I presume he must hold a certain amount of stock. I am not familiar with the details, but I know it to be a fact. The benefits to the employees were entirely wiped out this year, but they took it without grumbling. These remarks apply solely to the large works. The system of interesting the laboring man in the results of his labor has met with great favor. It is also done on the Continent in the Paris Gas Works.

Mr. Lowe—Does it do away with labor difficulties?

Mr. Grimwood—Yes; to a great extent I think it does. Of course, they are threatened with them. At the Gas Light and Coke Company's works a few years ago there was a large strike. I know that when I visited the works I saw an immense building, and was told that it was for the militia. I believe there was a time when the works were not inclosed. They had great difficulty on account of the strike, and since then they have built a fence around the grounds, and put up these large barracks where soldiers may be quartered in case of trouble. I think from that time on they had no difficulty.

Mr. Parker—How do they obtain high pressure at the gas tips in Paris?

Mr. Grimwood—They had a little pumping station in a small kiosk—everything nicely gotten up, and in perfect condition. There was a small gas engine with one man in charge.

Mr. Valentine—Was the gas taken from the holder?

Mr. Grimwood—I think it was taken right out of the mains—from one section of the mains to the other. In England there was not a great deal of interest in connection with the gas industry, at least it was

not my good fortune to meet with anything of the sort. I think there are about 1,000 gas works in Great Britain (not including Ireland) and out of that number I visited a mere handful. The works I visited were all old. There were some new works in the course of construction, as at Glasgow. At Edinburgh they were busy putting up a large works, which I did not visit. My time was so limited that all I saw was the old works, which was absolutely devoid of interest. There was a tall, old brick chimney, which had been pulled down to within a few feet of the base, and in it they had set up a bench of slopers. There are a great many works through England and the Continent that are using inclined retorts, and they are meeting with universal favor. I believe the new works at Provan are to be supplied with horizontal retorts and the Foulis charging and drawing machine. The retort is charged by a series of pushing movements. A mechanical pusher slides along in a trough, with a hopper above which drops into this trough a given quantity of coal. A man operates the whole thing by standing on a little platform. When the apparatus gets in front of the retort, a drawing machine comes along and draws the charge, which is carried away on railroad cars. Then the charger is brought up. A lever drops a certain amount of coal into the trough and the pusher drives it to the back of the retort, taking, I think, five strokes to fill the retort. In a minute the door is closed.

Mr. Valentine—I judge from your remarks that you saw nothing but coal gas works.

Mr. Grimwood—I saw water gas in quite a number of places. While there is a great deal of water gas, from our standpoint, made in England and on the Continent, it cuts such a small figure in comparison with the coal gas that it sinks into insignificance. I found that there is no due consideration given to the manufacture of water gas. At Glasgow I think they had 2 generators yielding 2,000,000 feet out of 16,000,000 daily output. I asked them about their water gas. They said, "Yes, we have 2 generators." But they did not seem inclined to show them, and did not appear to be particularly interested in them. Their time was entirely engrossed in the manufacture of coal gas, and that is the case all over England. My experience would lead me to believe that you could not find a single works where more water gas was made than coal gas. On the other hand, there are few places in California where more coal gas is made than water gas.

Mr. Britton—Has any member of the Association had any experience with high pressure pumping lines in his district for the distribution of gas under high pressure?

Mr. Lowe—I have done quite a little in my lifetime, but I think my only experience in California has been at Pasadena. We had 7 miles of 2-inch pipe running up the mountain for lighting the hotel and running a gas engine.

Mr. Britton—What was the pressure?

Mr. Lowe—It was not necessary to deliver it at high pressure in the valley. We had something like 40 or 50 inches pressure on the top of the mountain, owing to gravity alone, and the pump below we never had any use for except to operate experimentally. We had a 1,000-foot holder on the mountain, and the gas running in there supplied all that was necessary. I have built a great many gas works in California, the street main systems of which are designed for high pressure whenever it becomes necessary.

Mr. Britton—I would like to give some experience in connection with high pressure lines. Mr. McDonald will perhaps remember that, during the Western meeting at Chicago, I had some occasion to discuss high pressure distribution. I claim to be the pioneer in California in that line, having distributed at 140 inches water pressure. That was first used to pump gas from one city to another. Since that time, and particularly since the last meeting, I have followed up the work on entirely different lines. I had done something before the last meeting, but I had not perfected it so that I could talk about it. We now operate two pressure lines. One is 7½ miles in length, starting with an initial pressure of about 3½ pounds per square inch, with a pressure at the end of possibly 2½. Along that entire line we take off services wherever they occur, supplying directly from this high pressure line without any difficulty.

Mr. Osborn—Do you use governors?

Mr. Britton—Yes; a governor on each service. There is no diminution of the candle power in any way by reason of the pressure. At certain times of the night it is not necessary to pump, the consumption being so limited, and when the pump is shut off there is no difference in the flow of gas at the burner; the governor takes care of it perfectly. On the other line, 8 miles long, there is 3 pounds pressure, and at two different points smaller lines are supplied through the Connelly balance governor, with the greatest satisfaction. It would have cost a mint of money to have laid large mains from the works in order to have given these outlying districts a sufficient supply. Through a 3-inch pipe running 4 miles we are delivering in the neighborhood of 5,000 feet an hour as a maximum output. It is possible not only to do it in an economical way, but almost in any conceivable form that may suggest itself. Not only is this high pressure pumping line available for the district 7 miles away, but it is valuable in building up the pressures of the districts on either side, in case they should need it, by tapping in with the intervention of a governor. In my judgment, the era of large mains has gone by. The small main is going to be more satisfactory.

Mr. Osborn—What governor do you use on your services?

Mr. Britton—I am using the No. 2, of the Equitable Meter Company, of Pittsburg. There are other governors equally as good. They were called to my attention while in Pittsburg. One defect in their first construction was a vulcanized washer in the valve that became softened by the gas and change of pressure, and at some time or other would stick. They have corrected that by putting in a leather washer, and now for artificial gas they are sending out nothing but leather washers. The leakage has not risen at all. In fact I have less leakage than ever before. The system extends through cast iron mains, but we have many feet of wrought iron temporary mains that this high pressure is forced into.

Mr. Osborn—In the matter of leakage, do you speak of percentage or feet?

Mr. Britton—Percentage. Yet the amount of leakage per mile of main has not increased.

Mr. Lowe—I suppose you are constantly fixing your mains and keeping them in good shape.

Mr. Britton—Of course, our territory is particularly adapted to low leakage on account of the character of the soil, etc. We lay our mains with particular care, too.

Mr. Quilty—Do I understand that your candle power does not drop?

Mr. Britton—No. There was no variation perceptible in photometer readings between the holder and extreme point of delivery.

Mr. Grimwood—What effect has the increased pressure on the registration of the meters?

Mr. Britton—None, the governor counteracts that. The pressure upon the house pipes is no more than ordinarily, the governor being upon the outlet of the meter. The meters which I am using would stand a pressure of 3 pounds anyway.

Mr. Grimwood—I understand that they are supposed to stand a pressure of 50 pounds.

Mr. Lowe—That is what they claim. The Westinghouse meter will stand a pressure of 150, so I am told. There is no reason in the world why manufactured gas should not be handled in the same manner as natural gas. There is no reason why if we want gas under several hundred pounds pressure we should not use it.

Mr. Grimwood—It was the same with steam pressure. In the old days they used to think 25 pounds of steam was all that was necessary.

Mr. Britton—I think we are indebted to the electric light man for the notion of high pressure distribution.

Mr. Martin—I hope to be able to give you some practical results along this line next year. I am about to build new works in Grass Valley and Nevada City, where high pressure will be put into practical operation.

Mr. Britton—I think we have begun a new era. It will be simply a question of detail hereafter.

Mr. Lowe—I think that in selecting Mr. Grimwood to act as our representative we made no mistake. It is not our custom to vote thanks to a member because of his paper, but I think that in this instance we owe Mr. Grimwood something more. I, therefore, move that a vote of thanks be extended to Mr. Grimwood for the very able paper presented.

The President—If it is worthy of a vote of thanks, as I think it is, it is worthy of a rising vote. [Unanimously adopted.]

Mr. Grimwood—I thank you heartily for your appreciation of my efforts. I felt from the time that I left there were a great many men who could have acted as your representative better than I. It was simply a matter of circumstances. I happened to be able to go. I thank you, gentlemen.

The President—I believe Mr. Grimwood has one or two more items which he would like to give you to go on record in connection with his report.

Mr. Grimwood—I thought it might be well to mention the price

charged for gas at Zurich, $1.64. It is a municipal plant, and coal costs but $5.53 on the average. Now we pay as much more for coal, and sell our gas in San Francisco for $1.40. I think the prices charged in California, considering conditions, will compare more than favorably with the price at Zurich. It is true it is a saying in Europe that Zurich has paid twice for its plant. That may be so; but they have the finest plant ever built, and probably in the long run will find it economical. The statement was made in one of the papers in regard to gas statistics in Switzerland that the annual consumption per capita of population is from 80 to 90 and even 100 cubic meters, which in our measure would be equivalent to 2,824, 3,177 and 3,530 cubic feet per capita of population. In regard to inclined retorts, Herr Weiss quotes the instance of the town of Winterthur, a small works, with 2 stacks of 4 benches of inclines and mechanical conveyors, which give perfect satisfaction. I do not see why the inclined retort should not be used in California, if it can be used in 2 stacks of 4 benches. In regard to consumption of gas I quote the following statement from a paper by Herr Franz Schaefer (engineer) of Dessau, who has had occasion to collect some statistics in regard to consumption of gas in England. As compared with Germany, it is not very flattering to the latter. He says: "In London alone more gas is consumed annually than is made in the whole of Germany; and Great Britain, although possessing 15,000,000 less inhabitants than Germany, consumes 4 times more gas than the German Empire. This is partly because the industry has been longer established in England, and partly because of the price of gas, which is notably less in England on account of the very favorable prices paid for coal."[1] It is, I think, manifestly unfair to make comparisons between the price of gas in California and the price in England, particularly in Glasgow, where they had difficulty in finding a piece of ground large enough for a coal gas works, entirely free from coal findings. You should compare it instead with the price of $1.64 charged in Zurich on municipal account, with coal at $5.53 per ton. It is true that in giving the figure of $1.64 I have taken what is called the maximum rate. They have a number of rates, but that is what the ordinary consumer pays, and the rate usually quoted. They cut that price materially in supplying gas for certain purposes; for instance, for manufacturing.

The President then introduced Mr. George C. Holberton, of Oakland, Cal., who read a paper on the

COMPARISON OF METHODS OF SECONDARY DISTRIBUTION OF ALTERNATING CURRENTS.

[For the text of Mr. Holberton's paper, see JOURNAL, August 12, p. 245.]

Discussion.

Mr. Martin—Does Mr. Holberton contend that 256 times as large an area can be supplied by 440 volts, as compared with 110?

Mr. Holberton—Of course, when I say 256 times, I mean that we can distribute the same total load over an area 256 times as large. I brought out that point to show that, by the use of the 440-volt system, it is possible to reach a large class of consumers which if you had to put up individual transformers you could not reach at all.

Mr. Martin—In our lighting system in Chico we use No. 10 weatherproof, iron wire for our series lamps, and find it stronger than No. 6 copper.

Mr. Holberton—Even with the use of iron wire, I do not think that your saving would amount to as much as the transformer losses. In Berkeley we have districts where we are getting perfect satisfaction with consumers running 4,000 to 6,000 feet from the transformer.

Mr. Martin—I was not taking issue on the general principle. I have wired on heavy secondary distribution with large transformers in several districts, and, because of the difficulty in getting 220-volt lamps, we had to use 100 in buildings which were wired for 50 and 100 volts. Of course that only applies to the character of the work done in the small towns.

Mr. Holberton—We never go into a building with 440 volts. We keep the 440 in the street and balance the service by using 220 volt lamps in the houses.

Mr. Britton—Mr. Holberton's idea is to show some way by which long distances can be covered with small transformer losses.

Mr. Holberton—We have a 24-hour service in Berkeley of which 21 hours is run with large core losses.

Mr. Napthaly—Did you encounter any difficulty with consumers owing to the increased wattage consumption of the 220-volt apparatus?

Mr. Holberton—We have had no complaints of that kind. The trouble has been to reach them at all.

Mr. Napthaly—Of course, we are laboring under the same conditions here. I think we are in full accord with Mr. Holberton. It seems to me that the electric light companies could afford to make a reduction in their rates where they would have to supply 4-watt lamps. The decrease in the expense would enable them to give a lower rate. We have been contemplating something of the sort for some time. Of course, our Edison, 3-wire, underground system would not stand such a high voltage.

Mr. Britton—I think it will pay the members from the smaller companies to read that paper very carefully, because my observation leads me to believe that very many of the interior towns could benefit by the adoption of some such system.

Mr. Hollidge—What is to be gained by changing your transformers, wire and insulators and going into the houses with a large voltage? What is to be gained by increasing your voltage in the houses? Where does the small company have any gain in the matter?

Mr. Britton—That would depend upon circumstances. Mr. Napthaly or Mr. Holberton could answer that question.

Mr. Holberton—There are very few towns in which you have not at least two or three consumers on a block, and very few blocks of more than 600 feet. With the 440-volt system it is possible to reach out 12 blocks with No. 6 copper, provided the consumers use the average amount; whereas, if you tried to get the consumers the other way, you would have to put in a transformer for each house, and you would have to have a transformer capacity equal to the total number of lights in the house. Two transformers of the old type with their secondaries connected in series would be able to supply the whole district, owing to the fact that each transformer helps the other out.

[To be Continued.]

1. On account of the greater increase in Germany than in England, this relation has been somewhat modified lately in favor of Germany.

Expanded Metal for the Construction of Purifier Boxes.[1]

[A paper read by Mr. P. BACHELAY, of Toulon, at the Annual Meeting of the Society of French Gas Managers.]

This note has no other aim, and certainly no other pretension, than to make a suggestion which is, I believe, calculated to render some service to those of us who have to erect, or to extend, their purifier houses. Several of our colleagues—and they not the least well known—have before now spoken of constructing purifier boxes in masonry (Servier in 1876, De Lachomette in 1878, and Foucart in 1879), and of the building of gasholder tanks in metal and cement) Monier in 1886, and Bouren in 1893.) It is the application of this latter system of construction to purifier boxes to which I wish to refer for a moment to-day, because I do not think that it has yet been used for this particular purpose, and it seems to overcome altogether the objections raised to the adoption of boxes in ordinary masonry of bricks and cement.

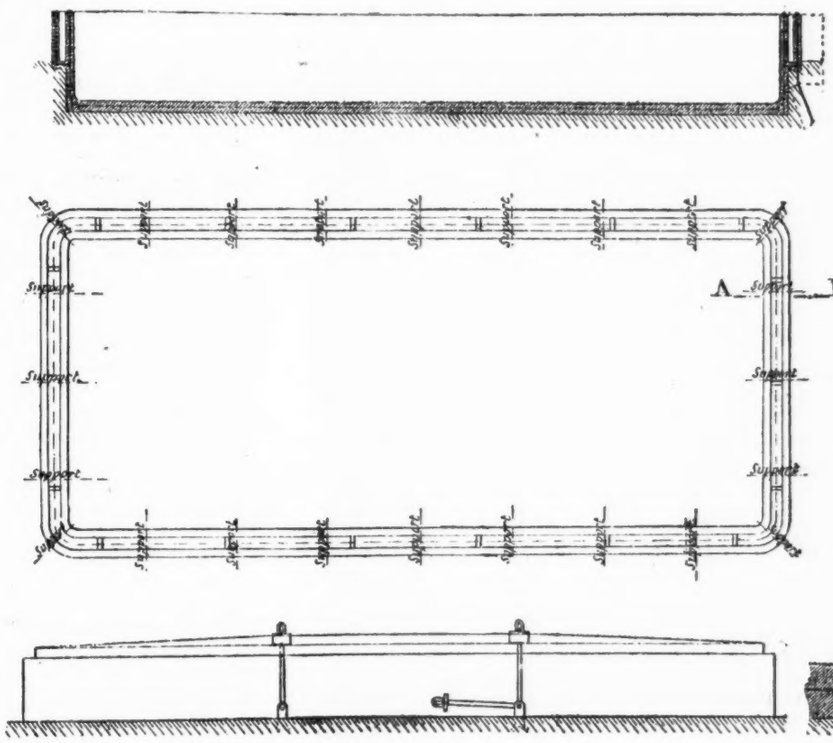
After the signing of the new agreement between the town of Toulon and the Société d'Eclairage, prolonging our right of existence for 21 years, and leaving 40 years before us, during which we shall have to arrange for insuring the manufacture and supply of gas to both the Municipality and private consumers, my Directors wished me to prepare a general scheme, but only to be carried out in successive parts, proportionately to the increase of consumption. Now, our works at Toulon, which a good many of you have seen, and which others will have, I hope, the opportunity of one day visiting, are established within the area of military regulations. * * * There is a fair extent of land belonging to the works, which may only be utilized, under the kindly eye of the ***Génie Militaire***, for depots of materials, and coal and coke; and, further, these stores must not be more than 2 meters (6 feet 6¾ inches) above the ground. But the erection of the smallest building is not to be dreamt of. Dame Government is there, and is wide awake. However, the erection of gasholders, which are movable plant, is fortunately allowed. Excuse this little pleasantry in the sphere of military things, which was necessary to explain to you why I had to decide upon using, for my purifier house, an old coal shed, just as it was, of ample area, but the spacing between the columns of which limited the size to be given to the boxes.

The utilizing of the various types of cast iron plates for purifiers shown in the catalogues of foundries in France and Navarre, did not seem likely to give satisfaction. One design of box did not leave the required space between it and the one adjacent, the middle of the space being unavoidably marked as the position of a column; another design of box left too much space, and so a doubly valuable area was lost—as

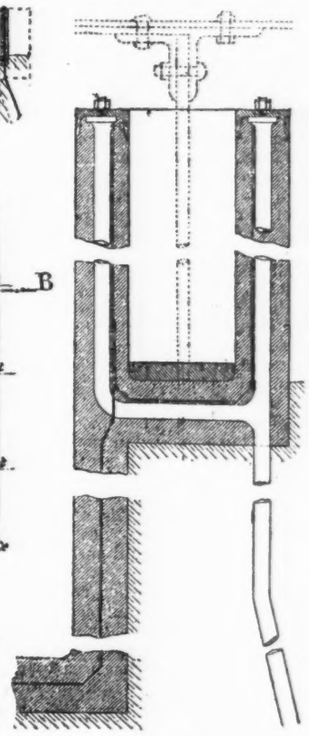
1. Translated for the London *Journal*.

purifying surface, and also covered surface, so to speak, were unemployed.

It seemed that I was reduced to making special and costly patterns, when I had the idea of adopting cement, strengthened by expanded metal, which not only allowed me to give the most arbitrary dimensions to the boxes, but also to agree exactly with the space which it was possible to allot them. The accompanying drawings show the



Section, Plan and Elevation of Purifier.



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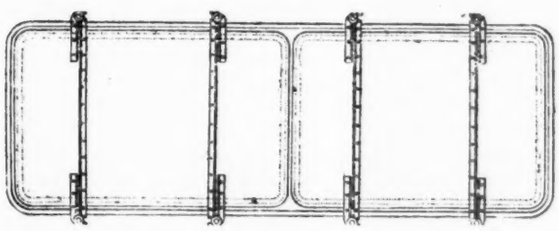

Type of Twin Boxes.

realization of this idea, which was carried out, after mutual examination, by the firm of Paufique Bros., of Lyons.

Boxes made in this way do not take up, on the horizontal plane, more surface than if they were formed by joining together cast iron plates; the vertical sides are only 9.06 m. (2⅜-inch.) thick, the same width as the flanges of metal plates. They are monolithic; very strong, and absolutely impervious. The edges of the lutes are protected by reversed ⊔-irons, easily saved from contact with the gas and purifying material by coats of tar. The jointing of the inlet and outlet pipes to the bottom is easily effected. The brickwork supporting the box is the same as if it were intended to carry a cast iron one. The fastening of the cover is done by means of ties fixed in the ground. These boxes can be built very quickly.

I may also add that, in case of accident, it is easier to do again a portion of the rendering over a crack in this special material, than to make a cement covering adhere to cast iron. Finally, there is another argument which appeals in favor of the system—it costs two-fifths less than the cast iron box, which is not, I think, to be despised at a time when there are so many unpleasant surprises in the price of iron.

I will finish this too long note by merely adding that this system lends itself to the construction of boxes, called "twin boxes" (one of the 4 lutes being common to another box), which have the advantage of increasing the purifying service for a given covered area.

Light.

[A lecture delivered by PROFESSOR IVISON MACADAM, of Edinburgh, at the 40th Annual Meeting of the North British Association of Gas Managers].

Mr. President and Gentlemen, the subject I have chosen for my lecture to you this day, while not of the usual "practical" character, has yet its practical side, for your business is the production of an article which shall, under certain conditions, produce light. Light may be derived from several sources, such as from the sun or other exterrestrial bodies, by the ignition of solids or gases, by phosphorescensce, by luminous animals, phosphorescence of decaying animal matter, electricty, and during certain crystallizations. When a solid body can be raised to a sufficiently high temperature without decomposition, it emits light. Gases under ordinary conditions are more difficult to render incandescent; but if, after heating, a solid body is introduced into the highly-heated result of chemical union, brilliant incandescence may occur. This last fact is what is made use of in the production of many artificial lights, such as the Welsbach burner, the lime light., etc., but of these I propose to speak more a little later on.

Some mineral substances when gently heated give off a more or less feeble light, which, however, does not as a rule last long, but soon ceases, and cannot be again renewed until the original substance has been exposed either to the light of the sun or to some artificial light. This is well noticed in some specimens of native phosphorite or calcium phosphate, and in the variety of fluor spar known as chlorophane. The sea is sometimes, as we know, rendered beautifully luminous by swarms of minute forms of animal life; and the light emitted by the glowworm and firefly is also known to us. Some forms of scolopendra actually leave a trail of light behind them. In these cases, oxygen seems to be necessary, as immersion in nitrogen or carbonic anhydride (carbonic acid) suspends the luminosity. Sea fish, especially whiting, herring and mackerel, soon after death become luminous. This is best noticed before decomposition sets in, and gradually disappears as putrefaction progresses. If the fish are placed in a weak saline solution, the liquid becomes luminous; but on the addition of pure water, the light disappears. The same result is obtained when lime water, fermented liquids, acid, or alkaline liquids, or very strong saline solutions are added.

When vitreous arsenious oxide is dissolved in hot hydrochloric acid, and the solution allowed to crystallize, each crystal as it is formed gives off a small spark of light; and similar results are obtained from fused nitrate of soda, etc. To account for the phenomenon of light, let

us suppose a perfectly elastic medium (ether), filling all space as well as the interstices of all material objects. This medium is susceptible of being thrown into undulations or vibrations, which cause light by impulses incessantly emanating from all luminous bodies. The light vibrations or waves would appear to have not only a forward tendency, but also a considerable sideward motion; and their contact with the eye appears to be somewhat similar to that of a hand drawn across the top of the head rather than by direct pressure.

Sound is similarly caused by vibrations, which, however, act on the air. The impulses are communicated by the motions of the particles of air to the ear. It is a well known fact that sound cannot be produced in a vacuum, while light readily passes through one. The sound waves are comparatively slow in their rate of travel, which is 1,120 feet per second through air (at 16° C.), 4,708 feet per second through water, and 11,434 feet per second through an iron wire.

There are two methods by which waves may be propagated: (*a*) In highly elastic media, the particles of the medium may undergo alternate condensation and rarefaction in the same direction as that in which the wave is travelling, as occurs in the passage of sound through air; or (*b*) the motion may be at right angles to that in which the wave is advancing, as in the undulations which produce light. When light diverges from a luminous center, its intensity diminishes as the square of the distance.

In the determinatiou of the relative iutensities of two lights which do not differ materially in color, we make use of photometry. In this process, it is usual to employ a standard candle made from sperm wax, and with a wick constructed to burn 120 grains of sperm per hour. Of course, in working with such a candle, variations must occur, and the candles must be checked for consumption; for the standard is really the amount of light produced by the consumption of 120 grains of sperm wax. Sometimes, however, a regulation burner is employed, so regulated as to burn a definite amount of a gas of a definite composition, as in the pentane burner. This latter process is, no doubt, the most accurate; but as the apparatus is the more costly, and the adjustments are more difficult to make, it has not been largely introduced into gas works.

Without going into all the details of checks and regulation of apparatus, the process consists in placing a candle at one point, and the light to be tested at another (opposite) point. A screen is then moved back aud forwards until a point is reached at which the shadows produced by the lights are equal. The distance from the screen to the lights is carefully measured. If the intensity of a light diminishes as the square of the distance, to find the relative value of the candle to the light tested we square the distance in each case from the light to the screen, and divide the product of the candle light into the gas light. The result is the relative value in candle power of the light being tested.

In gas testing, the result is generally given not only as the value in candles per 5 cubic feet of gas consumed, but also in its equivalent of grains of sperm wax per cubic feot of the gas. In coal analyses, these two results are also given; and, in addition, the right value of the gas from 1 ton of the coal in pounds of sperm. This latter figure is, to my mind, of much greater value than the other two; and in this I think you will agree with me, when you recollect the great difference in the number of cubic feet of gas, and in the quality of the gas, produced by variations in the temperature of the retorts, etc.

When a beam of light is transmitted through a prism, and the light is allowed to fall on a screen, we find that, instead of a beam of white light, we obtain what is known as a spectrum. This spectrum is made up of a series of bands, which grade into one another, and are colored red, orange, yellow, green, blue, indigo and violet. Of these, the red deviates least from its course, and is thus the least refrangible. The violet is the most refrangible. The light having been once decomposed into these colors by refraction, cannot be further decomposed; but by catching the rays on a reversed prism, they can again be easily transformed into a white light.

Objects which in themselves have no color, when placed in white light absorb some of these rays and reflect others. Green objects, for instance, are those which absorb the red rays, and reflect the yellow and blue. The rays so absorbed are said to be complementary to those reflected, and are always those which, along with the reflected rays would constitute white light.

Light of one tint is said to be homogeneous. Black bodies are those which absorb all colors; white bodies those which reflect all the rays. White light may also be decomposed by absorption, as is seen by passing a ray of light through a colored medium. But the light so obtained is seldom so pure as that secured from a prism; and it can therefore be frequently further decomposed by the prism.

The prismatic analysis of light is not, however, altogether due to the refractive power of the body; it also depends on the dispersive power, which is independent of the refractive power. A carbon bisulphide or oil of cassia prism has much greater dispersive power than ordinary flint glass; thus a much longer spectrum can be obtained by their use.

When the spectrum obtained from solar light is examined, it is found to be crossed by innumerable black bands, known as Fraunhofer lines; and these are always obtained, irrespective of the composition of the prism. They are also shown in the spectrum of the light of the moon and planets. These black lines may be "cosmic" in origin; but cosmic lines, being most plentiful in the ultra-violet part of the spectrum, are not so readily noticeable. Some of the black lines are caused by the absorptive power of certain gases; for gases have also the power of absorbing color. Each metallic substance, when sufficiently heated, emits light which, when passed through a prism, gives some distinct and characteristic bright lines. These lines are often produced by most minute proportions of the metals; and as they are absolutely characteristic, both in color and in the position in the spectrum, they form a means for the detection and identification of traces of the metals much to minute to be otherwise detected. The position of the line or lines produced by any substance never varies in position. If, then, the solar spectrum is divided by a scale, and the divisions numbered, we can, on obtaining a spectrum, compare the lines produced with those previously shown to be given with any definite substance; and only if the result be exact will we accept the evidence of the prescence of a certain body. Thus the yellow flame produced by sodium salts can be detected with so minute a proportion as 1-2,500,000th of a grain, cæsium to 1-170,000th of a grain, and the rubidium 1-33,000th of a grain. These twe last metals were discovered with ease by Bunsen in the Durkheim mineral water residues; but before they could be prepared as salts, Bunsen evaporated no less than 40 tons of the water, and then the total amount of the mixed chlorides obtained was under 200 grains. Other metals have also been discovered by means of spectrum analysis - such as thallium in a Belgian pyrites, and indium in a zinc ore.

When a substance is heated, it is not only rendered luminous and gives off rays of a certain and definite refrangibility, but it has also the power of absorbing lines of the same refrangibility. For instance, if the strong yellow light of sodium is transmitted through the vapor of sodium, only a black line is obtained in the spectrum; and that black line is situated on the exact part of the spectrum where otherwise a strong yellow line would be obtained. The black lines in the solar spectrum have thus in many cases been shown to be due to the absorption of the metallic lines by the vapor of the same metal evidently in a high state of incandescence. You will therefore readily understand how easy it becomes, by means of spectrum analysis, to analyze the light of the sun, moon, or planets, and to tell with absolute certainty the composition of these celestial bodies. Gases also give definite spectra; and we are therefore able to say that the sun has an atmosphere, and that the chromosphere which surrounds the sun is composed largely, if not entirely, of gaseous hydrogen.

The rays of the spectrum can, however, be further analyzed; for, by cutting off all the yellow and violet rays, we find that the red rays still produce heat; by cutting off the red and violet rays, we leave the light giving yellow rays, and by removing the yellow and red rays, we leave the violet rays, which still possess chemical properties. Thus it is possible to boil water with rays from the red end of the spectrum, which are practically invisible, or to photograph with rays from the ultra-violet end of the spectrum, which are also invisible.

In the gas works of this country, the product manufactured largely depends for its luminosity on the carbon it contains. In the ordinary batswing burner, there are the three well known zones, two of which, the central and the middle, are readily visible, while the third, or outer zone, is practically invisible. The central or dark zone was at one time looked upon purely as a useless area; and attempts were made to, as far as possible, eradicate it. It was readily noticeable that increased pressure not only reduced the general luminosity of the gas, but also increased the dark area; and it was further recognized that gas could be readily drawn away from that area in an unchanged state. The zone was, therefore, under the older theories, denominated the area of no combustion. Now, however, while acknowledging the effect of excessive pressures and the necessity for reducing them, the black area is looked upon as a useful and necessary part of the flame—as an oven, in which the gases, although not actually consumed, are to some extent, at least, broken up and prepared for the after combustion. The luminous area owes its incandescence to highly heated carbon particles; while the outer area is non-luminous on account of the fact that no solid particles are present. If a solid, such as platinum wire, is introduced into this non-luminous area, light is emitted.

The non-luminous or bunsen flame—sometimes called the atmospheric burner—differs from the batswing in so far as it burns a mixture of air and gas. It appears to be a common idea that such burners are more economical because of the previous admixture with air; but this, of course, is absurd, as a given quantity of gas must always be required to furnish a certain amount of heat, and a cubic foot of gas will always need a definite amount of air to burn it, whether the air be mixed with the gas before it passes to the burner or not. In the bunsen burner, however, one effect is distinctly noticeable—that the previous admixture with air has almost, if not entirely, removed the luminous area of the batswing burner. I say "almost," because if the bunsen is burning correctly, the luminous area is represented by a slightly luminous tip. The violet outer and visible flame is the representative of the non-visible area of the batswing.

Another practical difference is noticeable. The heat generated by both the batswing and the bunsen is the same for any given quantity of gas; but in the batswing the heat is radiated in all directions by the solid incandescent particles in the luminous area, while as no solid particles are present in the bunsen, the heat ascends almost entirely in a column. The heat is therefore in the bunsen more readily applied to a vessel placed above the flame; while for oven heating the luminous flame, from the greater radiation of heat, is probably the best.

The introduction of a solid substance into a non-luminous flame is now regularly practiced in the incandescent burners. Here the non-luminous flame impinges on a mantle composed of rare earths, such as cerium, didymium, lanthanum, etc. The earths are raised to a state of incandescence, and emit light. As the mantle components are already fully oxidized, no chemical change takes place in the mantle; and theoretically the incandescent substance is indestructible. Unfortunately, we have further to contend with the friable nature of the mantle components.

One point further regarding the Welsbach or incandescent gas burner. The light is not obtained from the constituents of the gas, except indirectly from the heat of combustion. A perfectly non-luminous gas, or a very low candle power gas, provided it in burning gives a sufficient amount of heat, should furnish just as good a light result as a high quality gas. This statement is, for all intents and purposes, correct. The introduction of plant for the manufacture of Mond gas of low luminosity and low price, may therefore in time become an important factor in household lighting; and the time may yet come when you will turn out from your works a non-luminous water gas suitable, not only for light giving with incandescent burners, but also for heating and for mechanical purposes. Such gas will, no doubt, be supplied at a very low cost; but it will be used in enormous quantity.

I have attempted, in the short time at my disposal, to give you a general outline of the subject—imperfect I admit it is—but I trust I have said sufficient to interest some of my audience who have not previously considered the subject of light, to set them thinking, and I hope to set them working, on a problem which is one of the most interesting I know.

The Standardizing of Electrical Equipment.[1]

We have now reached a point in the second stage of electrical development is this country which is fairly comparable to that reached in steam engineering a quarter of a century ago. The era of discovery and invention, in which electrical science progressed by leaps and bounds through a development so rapid as to be bewildering, seems to have come to an end. Perhaps this is more apparent than real. No doubt just as much investigation and experiment are now in progress as at any time since Edison began his work in the field of multiplex telegraphy, and every crude idea he ventured to communicate to a waiting world was a matter of greater international interest than matters connected with the policy of governments. The quadruplex telegraph, the telephone, the dynamo, the electric light, the storage battery, the electro motor, the X-ray and wireless telegraphy followed one another in such startling rapidity of succession that only the expert could intelligently keep pace with a progress which seemed to constitute one continuous "fairy tale of science" destined never to come to an end. What great and revolutionary discoveries in this boundless field remain to be made is at best a matter of conjecture.

During the past 5 or 6 years capital has offered very little encouragement to the inventor seeking electrical novelties, but a great deal to the patient and highly skilled mechanician who has been engaged in the task of making practical the brilliant discoveries which when announced possessed every quality of value except utility from the view point of the investor. As the result the progress during this period has been largely in lines of work for which the inventor is rarely fitted—that of standardizing apparatus and making systems commercially practical. In consequence of this attention to details, in which the mechanician rather than the electrician has had the more important task, every part of the apparatus needed for an electrical installation has been so nearly standardized that every requirement within the present state of the art can be met from stock or made from existing patterns and templets without experimentation. For example, an inquiry into the practicability of changing the motive power of the railroads entering and leaving the city of New York by the Park avenue tunnel of the New York Central & Hudson River Railroad from steam to electricity lately revealed the fact that more than one concern in the electrical supply business was ready to furnish everything needed as quickly as it could be turned out, and that for the entire equipment it would probably be unnecessary to make one new drawing or construct one new pattern. Some original work would doubtless be needed in installation, owing to the fact that the problems of the Grand Central switch yard are a little different from those existing anywhere else; but to meet these conditions involves merely adaptation of the kind which would construct a bridge of peculiar form without necessitating the rolling of new sections or the making of new forms in structural steel. In this standardization of electrical apparatus is found the secret of an electrical development so rapid and generally profitable that for some years to come it promises to overshadow every other department of business enterprise identified with the internal development of the country.

One feature of the change in electrical installations which is in the highest sense typical of the mechanical progress in adaptation of which we have spoken is noted in the gradual passing of the isolated light and power plants and their replacement by central stations. The introduction of the alternating system, immensely extending the area of profitable distribution, has changed all the conditions of public lighting and effected economies so important that only under exceptional conditions can the isolated small plant hold its own and make a profit for its owners. In the matter of power currents the important results attending the development of great water powers are more familiar to the general reader. Most of the original isolated light and power stations were in a sense experimental.

The plant was bought where it could be had cheapest, and much of it was of the variety which is best described under the general designation of "cats and dogs." Gradually the introduction of improved types of high speed engines and dynamos displaced from the market the cruder productions of the pioneer equipment companies, and superior industrial organization cheapened the cost of apparatus to a point at which competition in a small way in their production was no longer profitable. This narrowing of the field of the business to a few strong, well organized and well managed concerns, capitalized on a scale permitting them to undertake complete installations of any magnitude, facilitated the standardization of everything needed in lighting and power plants, and put both departments of electrical enterprise on a business basis impossible of attainment in the days when every maker of apparatus was a law unto himself.

1. *Iron Age.*

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At the annual meeting of the Dedham and Hyde Park (Mass.) Gas and Electric Company, the following officers were elected: Directors, S. R. Bertron, R. S. Storrs, E. E. Witherby, Chas. E. Hellier, and G. F. Gridley; Treasurer, S. R. Bertron; Clerk and Superintendent, Edwin M. Walker.

Mr. S. J. Fowler, formerly Manager and Superintendent of the Springfield (Mass.) Gas Light Company, has been appointed Treasurer and Manager of the Charlestown (Mass.) Gas and Electric Company.

A water gas plant is being installed on the works of the Citizens Gas Company, of Taylorville, Ills.

The office of Second Vice-President was recently created by the Directors of the Oakland (Cal.) Gas, Light and Heat Company, and Mr. H. A. Hedges, of San Francisco was elected to the position.

The properties of the La Crosse Gas Light Company, the Edison Light and Power Company, the Brush Light and Power Company and the La Crosse Electric, Hot Water and Heating Company, all of La

Crosse, Wis., have been purchased by a syndicate of Chicago capitalists. The different interests are to be consolidated and recapitalized.

JUDGE LOCHREN has authorized the sale at foreclosure of the properties of the Faribault (Minn.) Consolidated Gas and Electric Company. The proceedings were instituted by Mr. Howard C. Levis, who holds bonds on the property amounting to $75,000.

A CORRESPONDENT, writing under date of the 8th inst., forwards the following: "The properties of the Paducah (Ky.) Gas Light Company, which were sold, by order of the Court, March 20th, to Mr. Thomas Coffey, of Peoria, Ills., have been placed in charge of Mr. F. H. Lane, an experienced gas man, and formerly Superintendent of the Peoria Gas Light and Coke Company. Mr. N. Schumer, who was also connected for a number of years with the Peoria Company, was put in charge of the distribution system at Paducah. With these two gentlemen in control it is certain that Paducah will be a winner. They report that up to August 1st, 140 gas stoves had been placed, and they stoutly aver that before the stove season is over they will have at least 200 gas ranges in use, and that the number of gas consumers will be increased at least 33 per cent. All this seems pretty good for the Paducah gas trade, especially when one remembers that it was in a receiver's hands last spring, and that the plant was badly run down."

THE New Bedford (Mass.) Gas and Edison Light Company shareholders have elected the following officers: Directors, H. G. Howland, T. H. Knowles, J. P. Knowles, Jr., C. R. Price, Geo. R. Stetson, C. H. Lawton, F. Taber, A. G. Pierce, O. Prescott, Jr., J. S. Perry and H. M. Knowles. Mr. Charles R. Price was again chosen Treasurer and Clerk. The Company's business prospers.

OWING to ill health, Mr. Isaac J. Wild, for many years Treasurer of the New Haven (Conn.) Gas Light Company, has resigned that position. His successor has not yet been appointed.

THE proprietors of the City Heat and Light Company, of Fostoria, Ohio, have notified the residents that, on and after September 1st, the net selling rate for a supply of fuel gas will be 50 cents per 1,000 cubic feet. The present rate is 50 cents per 1,000.

THE proprietors of the Winchester (Va.) Gas and Electric Light Company have voted to expend $5,000 on plant betterment. The main part of the appropriation is to be put into the electric lighting division of the works.

MR. J. FRED. SEAMON, General Manager of the Rockville (Conn.) Gas and Electric Company, has notified the customers of the Company that, on and after September 1st, no account for less than 50 cents will be rendered each month for a gas supply. The payment to be made on electric account each month is put at $1.

THE contract for the public lighting of the streets of Streator, Ills., in so far as that is performed by means of arc lamps, has been awarded to the Streator Gas and Light Company for a period of 5 years. The rate agreed on is $82 per lamp per annum. The old rate was $90. The Council has agreed to extend the Company's franchise for a term of 25 years.

THE people in interest in the Bordentown (N. J.) Gas Company deny that that plant has been purchased by the South Jersey Gas, Electric and Traction Company.

"F. A. L." is informed that the Directors of the Cooperstown (N. Y.) Gas Company are: G. Falkenstein, J. Warren Lamb, H. L. Cooke, W. P. K. Fuller and John Smith. The Company proposes to improve the plant this fall.

THE Niagara Falls (N. Y.) Gas and Electric Light Company has filed a mortgage of $150,000, the trustee being the Trust Company of America.

THE Texarkana (Texas) Gas and Electric Company has filed an application for a renewal of its charter.

MR. ALBERT S. HAMMERLE is no longer in the service of the Hamilton (Ohio) Gas Light and Coke Company.

THE Excelsior Coke and Gas Company, of Topeka, Kas., recently filed suit for a perpetual injunction in the United States Circuit Court restricting the City of Topeka from enforcing an ordinance reducing the price of gas to $1 per 1,000 cubic feet. The ordinance was passed July 17, and imposed a fine of $25 on any person attempting to collect more than $1 per 1,000 cubic feet. It was alleged in the petition that the ordinance is an attempt to confiscate the property of the Company without due process of law, that it interferes with vested rights, and avers that gas cannot be manufactured in Topeka, at a minimum rate of $1 per 1,000 cubic feet, without a loss to the Company. Judge Hook granted a temporary restraining order until a hearing can be had in Wichita, September 16.

THE lease under which the Citizens Gas and Electric Company is operating the plants of the Council Bluffs (Iowa) Gas and Electric Company was filed for record early this month. Under the terms of this lease, which is to run for 99 years, from December 21, 1900, the Citizens Gas and Electric Company is to pay an annual rental equivalent to 90 per cent. of the net earnings. In order to arrive at the net earnings the following are to be deducted from the gross receipts: All ordinary operating expenses, interest on bonds of both the Council Bluffs and Citizens Gas and Electric Companies, sufficient money to pay for sinking fund provisions in the mortgages of both companies, all moneys for improvements and maintenance of the gas works and electric light plant which in the opinion of the Citizens Gas and Electric Company should be paid out of the earnings, the salaries of officers of the Citizens Company, and taxes and ordinary expenses of both companies.

THE Bridgeport (Conn.) *Farmer* is responsible for the following: "Holders of the majority of the stock of the Bridgeport Gas Light Company have accepted the offer of Samuel Thorne, of New York, of $75 a share for their holdings, and other stockholders of the Company have received a notice to that effect, advising them to signify their acceptance before the expiration of the option, August 15. Mr. Thorne is understood to represent the bondholders of the defunct Citizens Gas Company, who are preparing to lay out $500,000 or more to obtain control of the field here. The option expires August 15, and the postponed sale of the Citizens Gas Company is scheduled for August 14. The Bridgeport Gas Light Company, at the present time, has outstanding stock amounting to $300,000. The last General Assembly gave authority to issue stock not exceeding $1,300,000, but this has not been done. The old Company contemplated taking over the property of the Citizens Gas Company. The present deal, it is understood, is in the interest entirely of bondholders of the Citizens' Company, who figure upon this method of saving their investment in the new plant. To secure the controlling interest in the old Company will take nearly $500,000, and to purchase the entire stock under the proposition made would necessitate an outlay of $900,000. As is generally known, the Citizens Gas Company defaulted upon its bonds, and the plant in this city went into the hands of Frank Miller, as Receiver. The plant represented an investment of about $1,000,000, according to the statements of those originally interested in the Company. Mr. Miller advertised the property for sale some months ago, but the sale has been adjourned from time to time, the last postponement being until August 14. The Bridgeport Gas Light Company, when it obtained the right to increase its capital stock from $300,000 to $1,300,000, and the privilege of issuing bonds to the amount of about 75 per cent. of its capital, intended taking over the Citizens plant."

THE St. Paul (Minn.) *Globe* recently said: "Defective electrical wiring, and the presence of a network of high voltage wires combined with quantities of dead wires that traverse many of the business blocks in St. Paul, have been responsible for three fires in St. Paul during the past month. Chief Jackson made the statement to the Board of Fire Commissioners, and it was further supplemented by Assistant Electrical Inspector Varnam, who said that if he devoted all his time to condemning and ordering the removal of 'tramp' wires he would be able to do nothing else. Mr. Varnam's work is confined mostly to the inspection of electrical wiring, permits for which are taken out daily, and in this connection he informed the Board he has come across wiring from which it was simply a miracle fire had not resulted. In this connection he had ordered the rewiring of the entire Masonic Block on Wabasha street, while similar orders had been given to the owners of the Ryan Hotel. The work of reconstruction in these two buildings, he said, cost several thousand dollars. The Gas Company, Mr. Varnam informed the Board, had now a large force of men at work, and by Sept. 1 hoped to have all its wires 'underground' in the business district. This Company handles high voltage wires almost

(*Concluded on page* 295.)

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AGENTS:

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MONDAY, AUGUST 19, 1901.

(*Continued from page* 294.)

entirely, and it is the presence of these that causes fire and results in accidents. Crossed by telephone wires, fire and accidents are inevitable, consequently their presence is a menace to property and life."

CAPTAIN JOHN P. KEISER, President of the old Laclede Gas Light Company, of St. Louis, Mo., until its reorganization, died at Penetang, Ontario, the morning of July 27th. He was in his 68th year, and in the early sixties was famous as a steamboat man on the Missouri and Mississippi rivers.

The Market for Gas Securities.

The market for city gas shares showed quite some animation this week, Consolidated selling up to a figure higher than that made for it since early last June. Yesterday (Thursday) it sold a fraction over 125, but "realizing sales," even though such amounted to only 300 shares, were sufficient to cut the price to-day to 223¾. The closing was made at 222½ to 223½. The near approach of the dividend time, which means a declaration of 2 per cent. and no more, is likely the real cause for whatever extra strength the shares have reflected for the past fortnight. Mutual keeps up to the notch quoted since June 1st. The quotation, however, is nominal, and it should be worth on its merits about 100 points higher than the current marking. The plans for the gigantic plant at Astoria are being quietly, but nevertheless steadily pushed along.

Brooklyn Union is 214 bid, offered at 217 ex-div. of 2 per cent. Peoples of Chicago, ex-legal scare, is 113, bid, which looks 12 points below its worth. Bay State is "unchanged." Baltimore Consolidated shows no change, but the story will be different regarding it next fall. If it isn't worth 75 the wirter's knowledge of gas share values is nil. A feature of the summer market in gas shares this year oddly shows that such securities have exhibited greater strength on the average than that recorded in any other distinctive group of industrial stocks.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks,

16 WALL STREET, NEW YORK CITY.

AUGUST 19.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	222½	223¼
Central Union, Bonds, 5's.	3,000,000	1,000	109	110
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	115	118
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	305	315
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
New Amsterdam Gas Co.. Bonds, 5's	11,000,000	1,000	108¾	109¼
Northern Union, Bonds, 5's.	1,250,000	1,000	106	108
New York and East River.. Bonds 1st 5's	3,500,000	1,000	111	115
" 1st Con. 5's	1,500,000	..	108	111
Richmond Co., S. I.	348,650	50	100	..
" Bonds	100,000	1,000	103	..
Standard	5,000,000	100	135	..
Preferred	5,000,000	100	153	.
Bonds, 1st Mortgage, 5's	1,500,000	1,000	113	115
Yonkers	299,650	500	120	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	215	217x
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	1	1⅛
" Income Bonds	2,000,000	1,000	.	75
Binghamton Gas Works,..	450,000	100	30	40
" 1st Mtg. 5's	509,000	1,000	92½	95
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	6	8
" " Bonds, 5's	5,250,000	1,000	73	76
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	.	
Central San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co..	29,500,000	100	104¾	105¼
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	106	107
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,000	1,000	102	103
Consumers, Toronto	1,700,000	50	215	216
Consolidated, Baltimore...	11,000,000	100	65	66
Mortgage, 6's	3,600,000	..	..	115
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	12	14
" Con. Mtg. 5's	380,000	1,000	81½	83
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,825,500	50	.	89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	89	89½
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	34	38
Fort Wayne	2,000,000	..	..	.
" Bonds	2,000,000	..	54	58
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	102	104
Hartford	750,000	25	240	250
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	60	66
" Bonds, 6's	2 650,000	..	99½	101
Jackson Gas Co.	250,000	50	65	70
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	101½	103
Laclede, St. Louis	10,000,000	100	87	93
Preferred	2,500,000	100	100	102
Bonds	10,000,000	1,000	..	108½
Lafayette Gas Co., Ind.	1,000,000	100		60
Bonds	1,000,000	1,000	48	55
Louisville	2,570,000	50	110	120
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	102½	108
" 6 per cent. scrip, due 1910	100,000	25	87	89
Montreal, Canada	2,000,000	100	182	184¾
Newark, N. J., Con. Gas Co	6,000,000	..	..	55
Bonds, 6's	4,600,000	..	..	103
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	113	113¼
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	46	46½
St. Paul Gas Light Co	1,500,000	100	60	63
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's	2,465,000	1,000	88	90¼
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	85	87
Syracuse, N. Y.	1,750,000	100	18	22
Bonds	1,612 000	1,000	91	93
Washington, D. C	2,600,000	20	298	300
First mortgage 6's	600,000	..	..	..
Western, Milwaukee. Bonds, 5's	4,000,000	..	106	108
Wilmington, Del.	600,000	50	210	215

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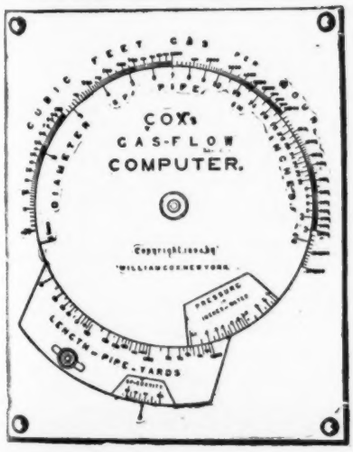

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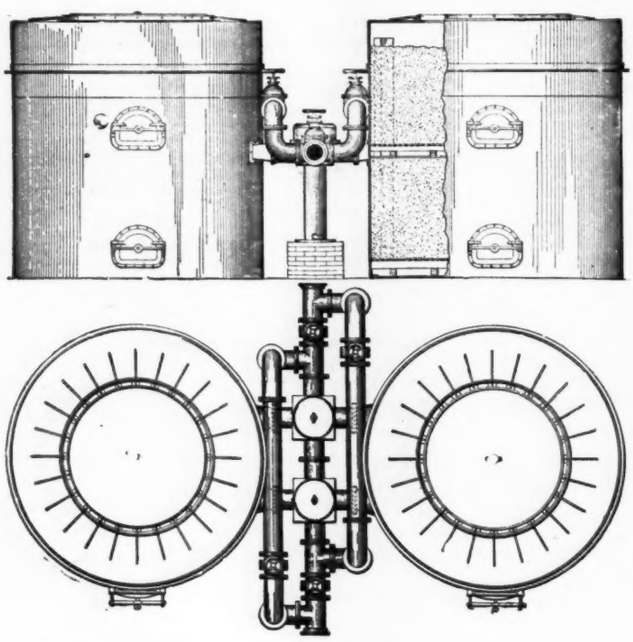

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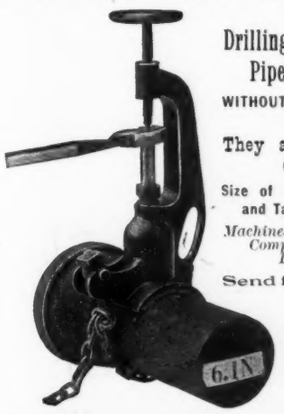

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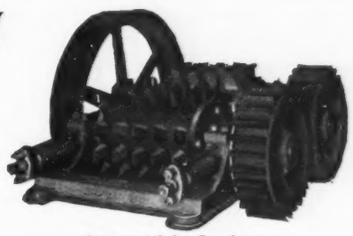

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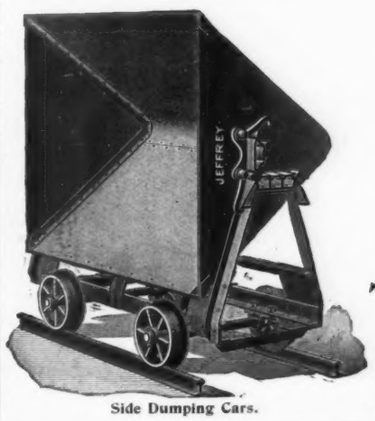

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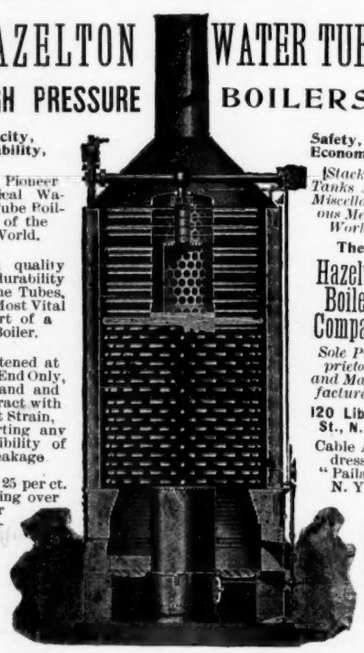

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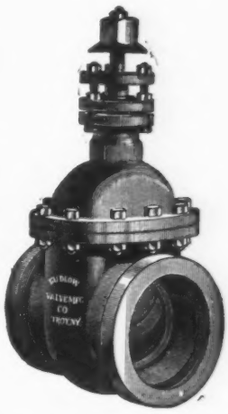

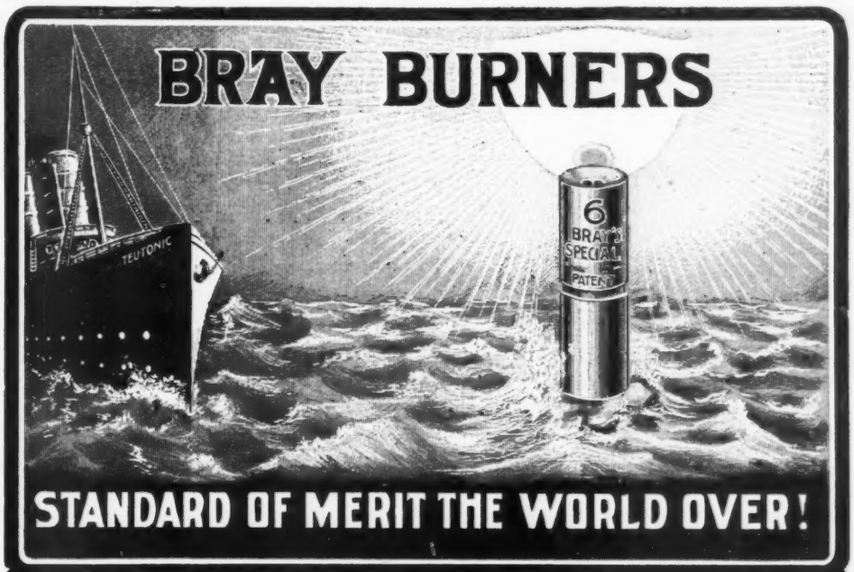

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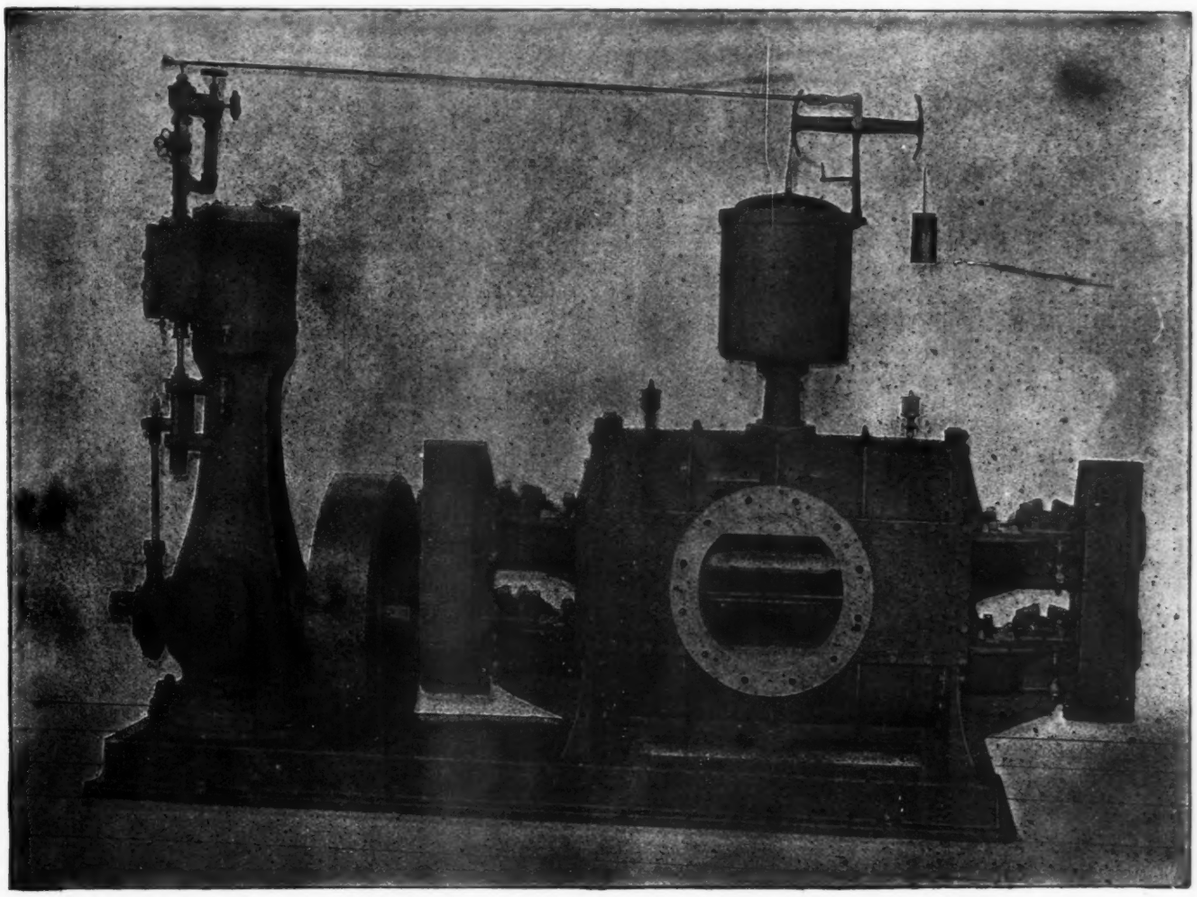

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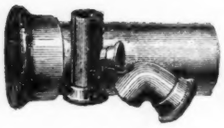

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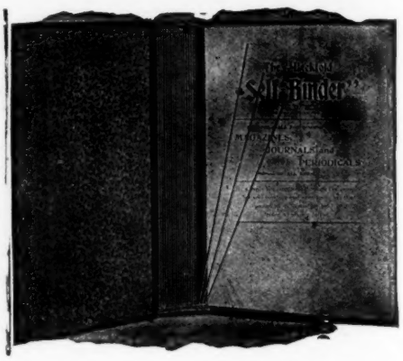

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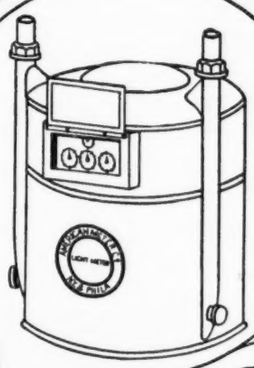

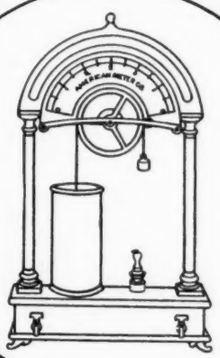

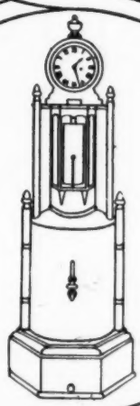

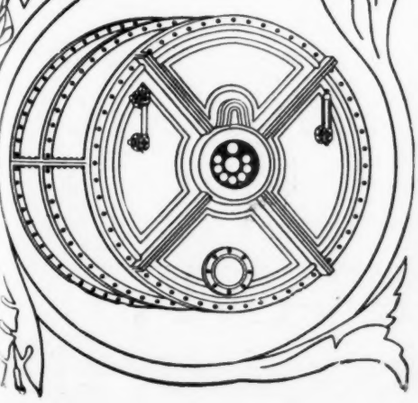

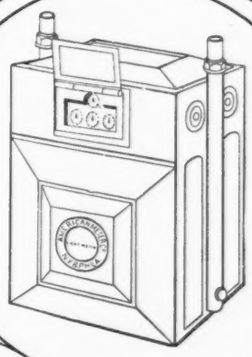

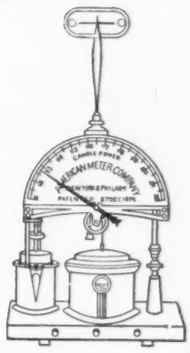

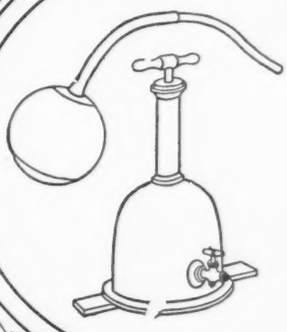

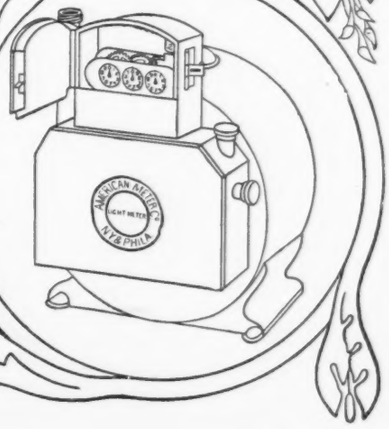

PUBLIC LIGHTING TABLE.

SEPTEMBER, 1901.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Sun.	1	7.00 PM	9.00 PM	6.30	4.20
Mon.	2	7.00	9.40	6.30	4.20
Tue.	3	7.00	10.20	6.15	4.30
Wed.	4	7.00	11.10	6.15	4.30
Thu.	5	7.00 LQ	12.10 AM	6.15	4.30
Fri.	6	7.00	1.10	6.15	4.30
Sat.	7	7.00	2.10	6.15	4.30
Sun.	8	6.50	3.20	6.15	4.30
Mon.	9	6.50	4.40	6.15	4.30
Tue.	10	6.50	4.40	6.05	4.40
Wed.	11	6.50	4.40	6.05	4.40
Thu.	12	6.50 NM	4.40	6.05	4.40
Fri.	13	6.50	4.40	6.05	4.40
Sat.	14	6.50	4.40	6.05	4.40
Sun.	15	6.40	4.40	6.05	4.40
Mon.	16	6.40	4.40	6.05	4.40
Tue.	17	7.30	4.40	5.55	4.50
Wed.	18	8.10	4.40	5.55	4.50
Thu.	19	8.50	4.40	5.55	4.50
Fri.	20	9.40 FQ	4.40	5.55	4.50
Sat.	21	10.40	4.40	5.55	4.50
Sun.	22	11.40	4.50	5.55	4.50
Mon.	23	12.40 AM	4.50	5.55	4.50
Tue.	24	1.50	4.50	5.40	5.00
Wed.	25	2.50	4.50	5.40	5.00
Thu.	26	No L.	No L.	5.40	5.00
Fri.	27	No L. FM	No L.	5.40	5.00
Sat.	28	No L.	No L.	5.40	5.00
Sun.	29	6.10 PM	7.40 PM	5.40	5.00
Mon.	30	6.10	8.20	5.40	5.00

TOTAL HOURS LIGHTING DURING 1901.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	220.10	January	423.20
February	192.30	February	355.25
March	180.00	March	355.35
April	158.30	April	298.50
May	140.40	May	264.50
June	135.40	June	234.25
July	138.00	July	243.45
August	156.20	August	280.25
September	174.40	September	321.15
October	202.30	October	374.30
November	220.40	November	401.40
December	241.30	December	433.45
Total, yr.	2161.10	Total, yr.	3987.45

NEW YORK, 33 Nassau Street. PHILADELPHIA, Broad and Arch Streets. CHICAGO, Foot of Orleans Street. BOSTON, 624 Tremont Building.
CLEVELAND, 809 Cuyahoga Building. ST. LOUIS, 712 Roe Building. SAN FRANCISCO, 712 Polk Street.

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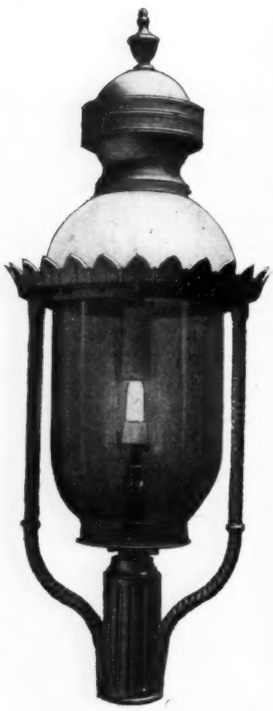

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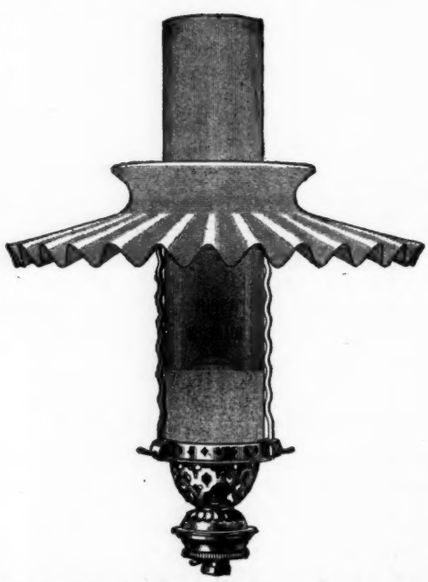

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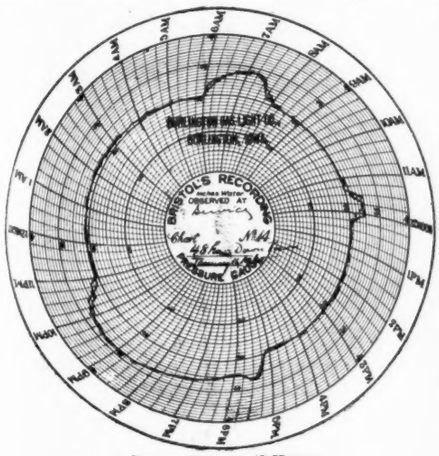

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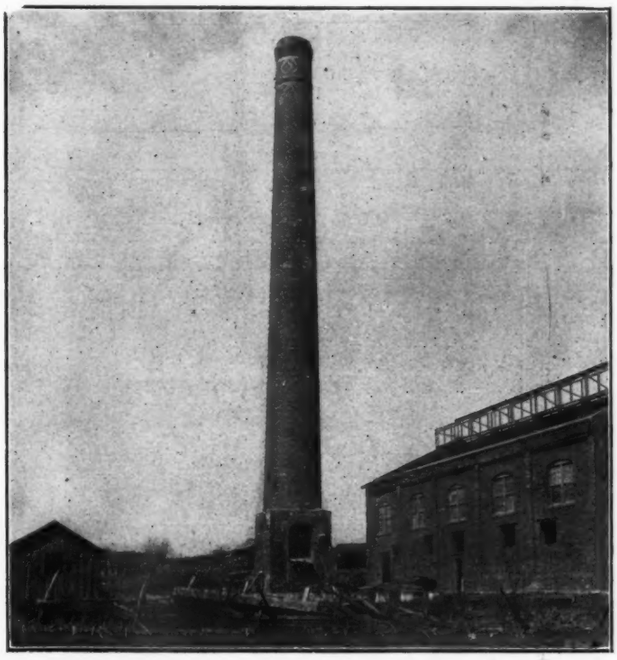

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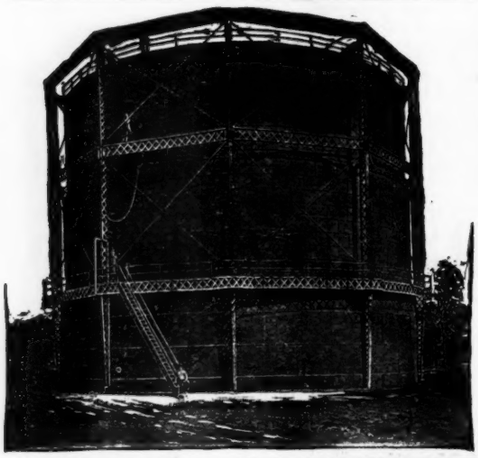

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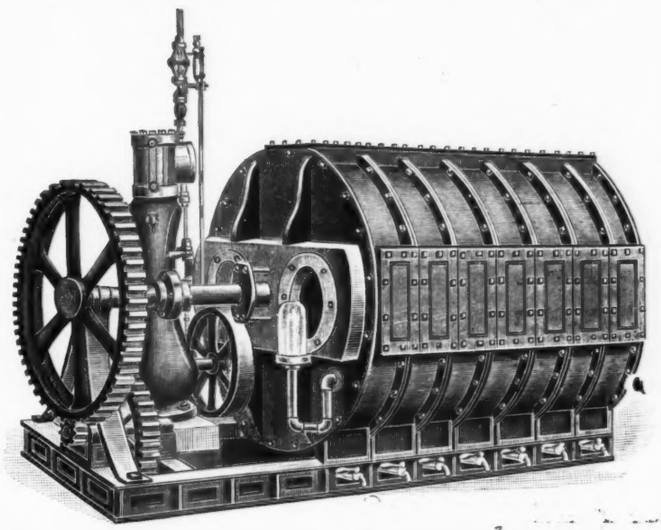

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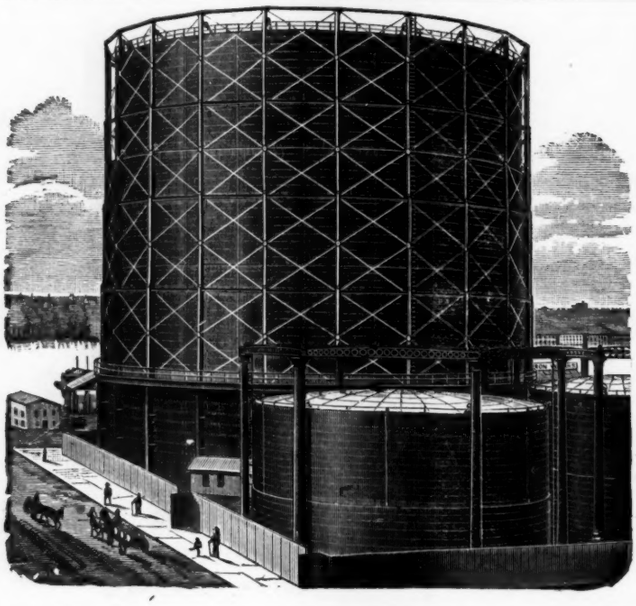

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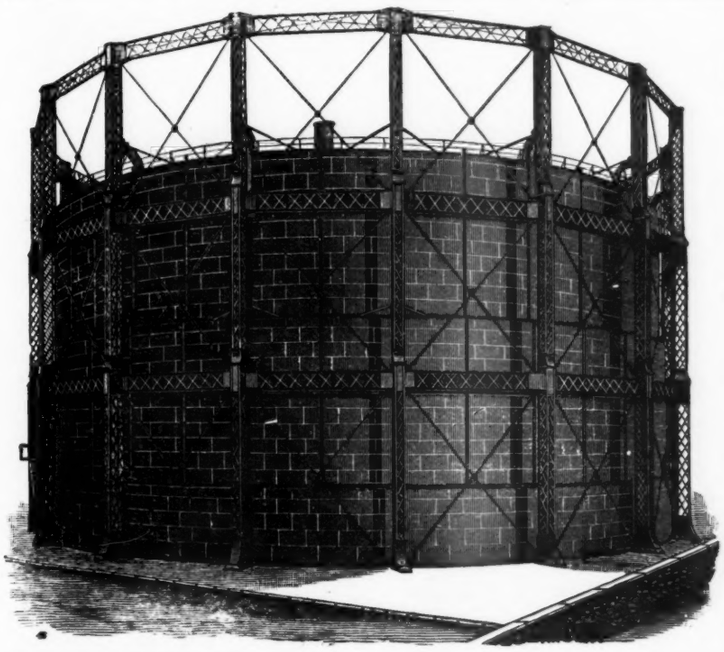

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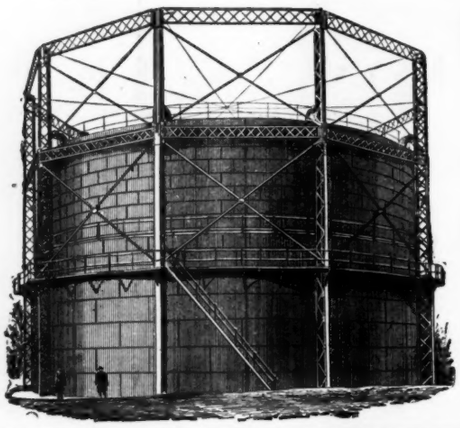

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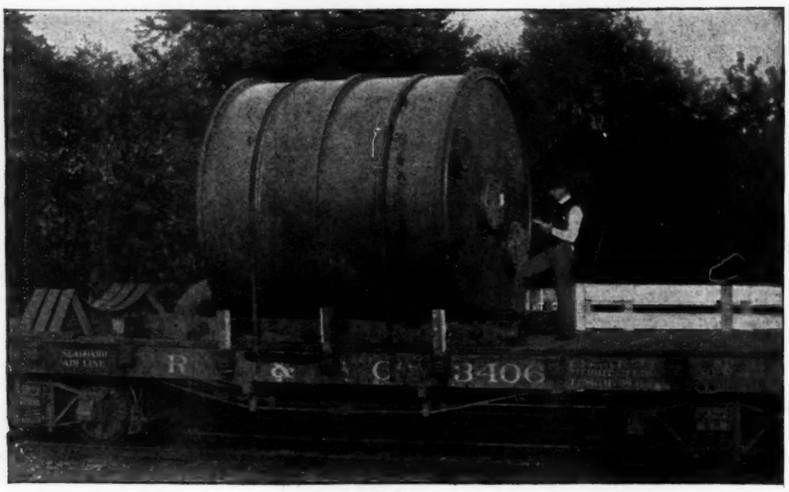

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